NEBRASKA LONG PINE CREEK RURAL CLEAN WATER PROGRAM

TEN YEAR REPORT 1981-1991

NEBRASKA

LONG PINE CREEK
RURAL CLEAN WATER PROGRAM
10 YEAR REPORT
December, 1991

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Environmental Control

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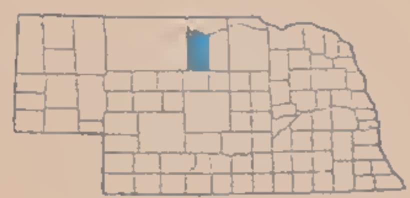
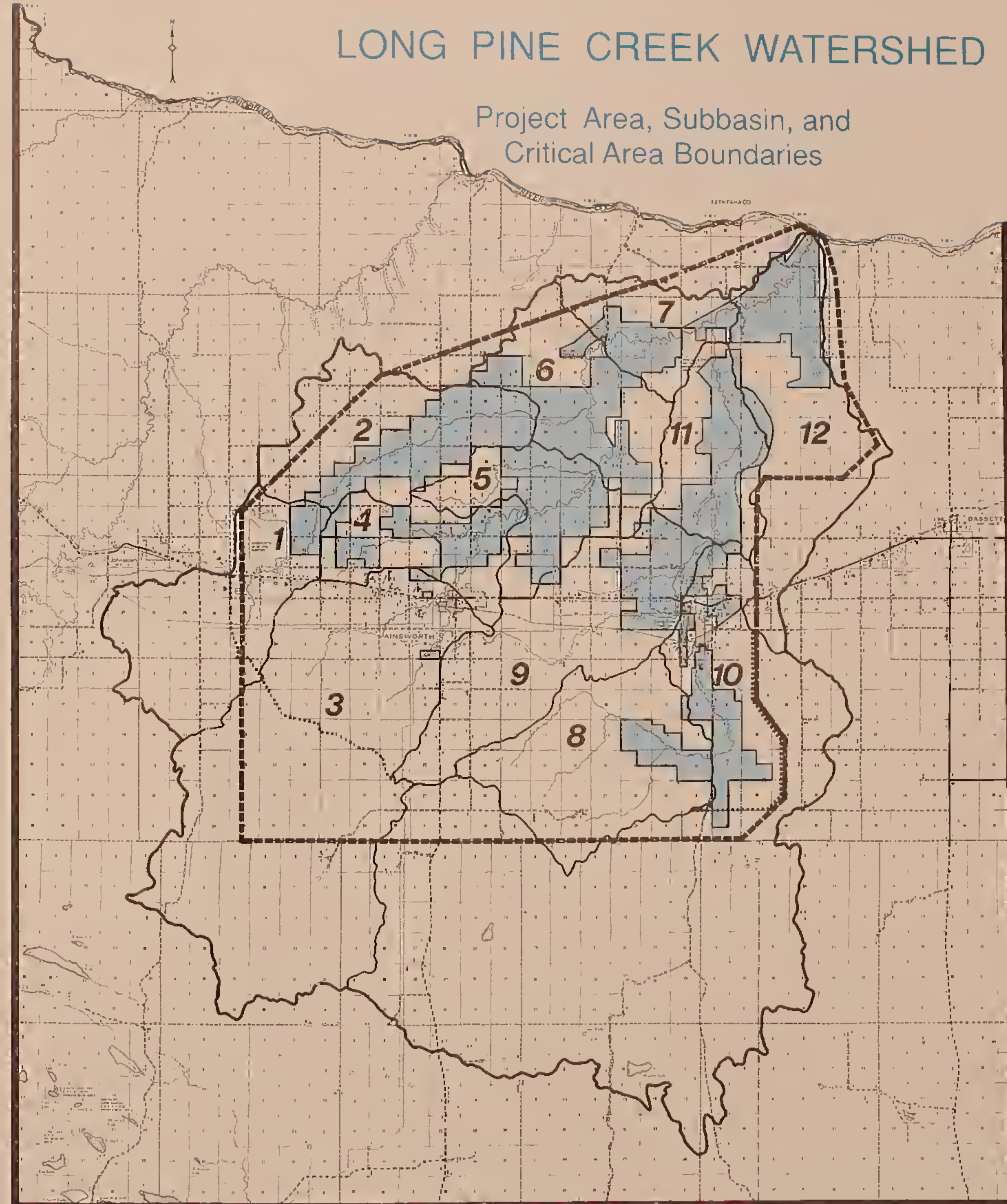


KEY TO COUNTIES

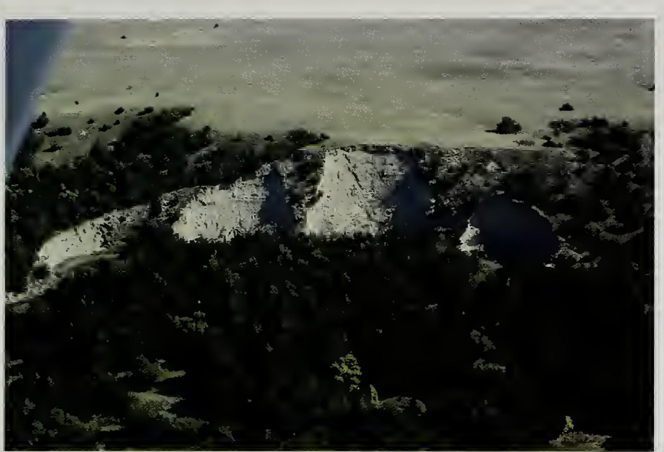


LEGEND

———	Watershed Boundary
■■■	RCWP Project Area Boundary
———	Subbasin Boundary
······	Surface Water Drainage Boundary
(shaded)	Critical Area

Nebraska Department of Environmental Control
1992

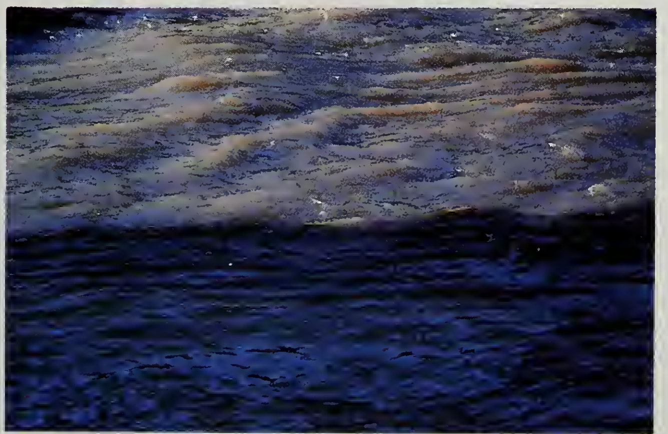
Watershed Problems


Streambank Erosion

Water Erosion



Wind Erosion

Sedimentation Entering Pine Creek


Watershed Problems

Irrigation Tailwater Leaving Field And Entering Pine Creek

Livestock Access to Streams

BMP 13 — Improving an Irrigation and/or Water Management System (Ainsworth Irrigation District Secondary Reservoir)

AID Structure In Use — Irrigation Water Diverted Following a Heavy Rain

Diversion Gate — AID Secondary Storage Structure

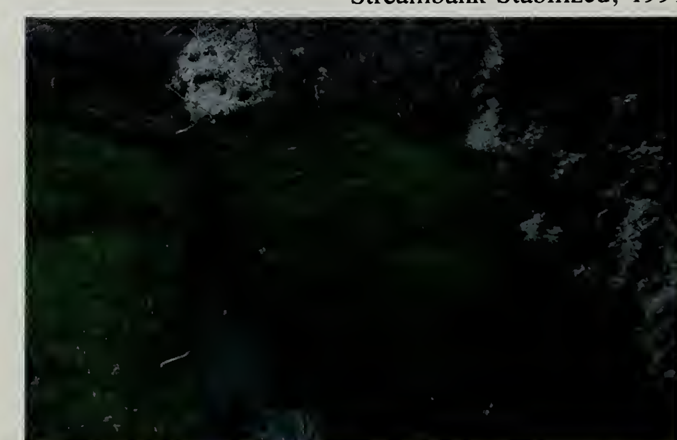
BMP 10 — Streambank Stabilization — Cedar Revetment


Bare Banks, 1984

Revetments Installed, 1986



Reed Canarygrass Established, 1990

Streambank Stabilized, 1991


Willow Creek Roadside Critical Area Treatment (CAT)

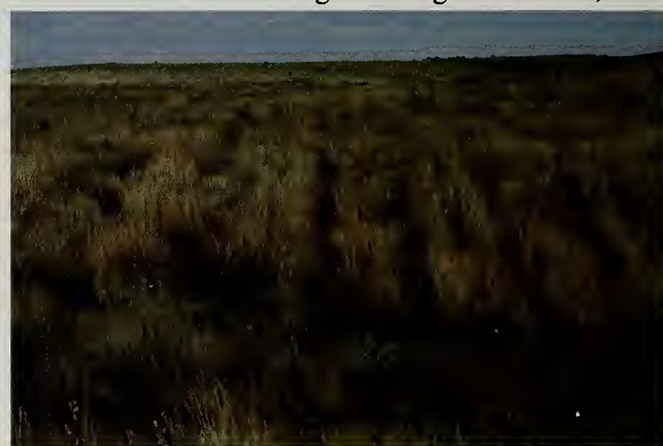
Facing Uphill, 1983

Facing Downhill, 1991

BMP 1 — Permanent Vegetative Cover — Range Seeding

Site 1 — Cropland Seeded To Range, 1987

Range Seeding Established, 1991



Site 2 — Cropland Water Erosion, 1981

Range Seeding Established, 1991

BMP 6 — Grazing Land Protection System
(Fencing Livestock From Stream)

Streambank Damage June, 1989

Livestock Excluded From Stream Aug., 1989

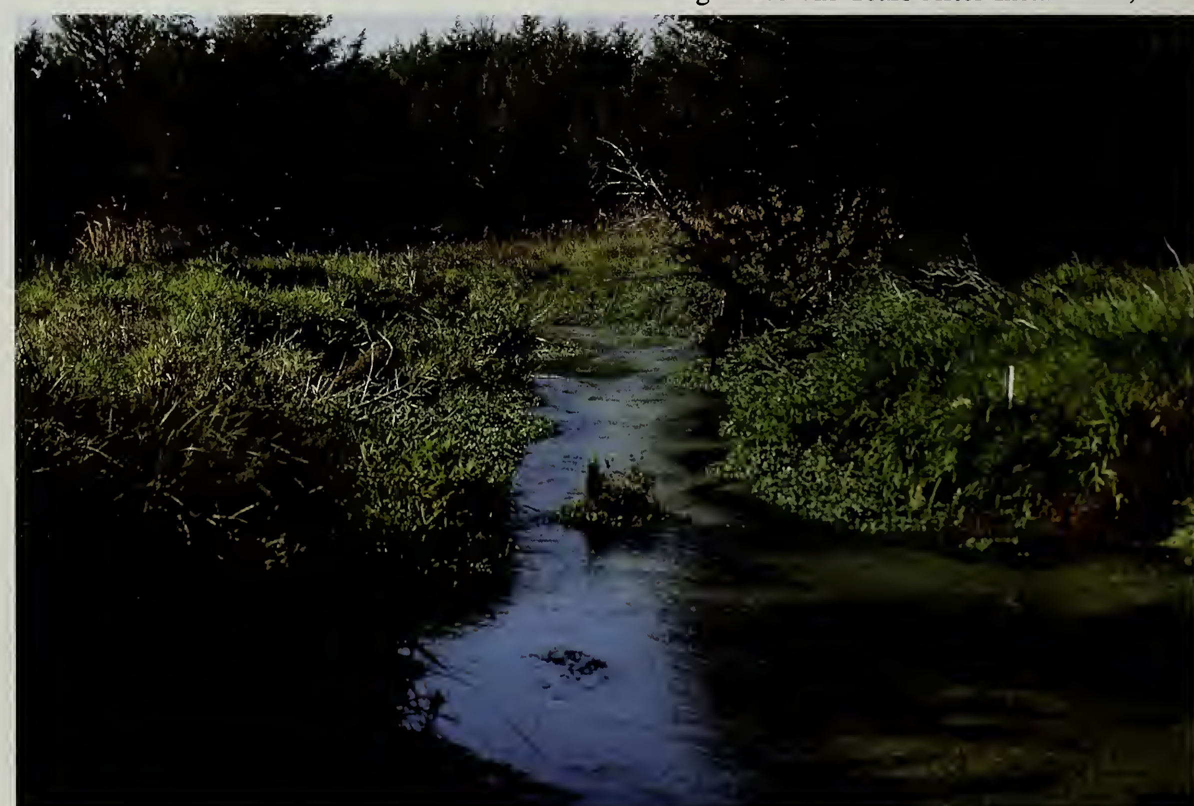
Livestock Damage To Channel, 1981

Stream Protected From Livestock, 1990

BMP 10 — Stream Protection System

Wing Dikes Six Weeks After Installation, 1985

Wing Dikes Six Years After Installation, 1991



BMP 7 — Waterway System

Experimental Enkamat Installation for Grassed Waterway, 1983

Grassed Waterway Established, 1991

BMP 12 — Sediment Retention, Erosion or Water Control Structure

Severe Gully Erosion, 1984

Gully Revegetated Following Dam Installation, 1990

BMP 12 — Sediment Retention, Erosion or Water Control Structure

Eroding Drainage Area, 1985

Dam Construction, 1985

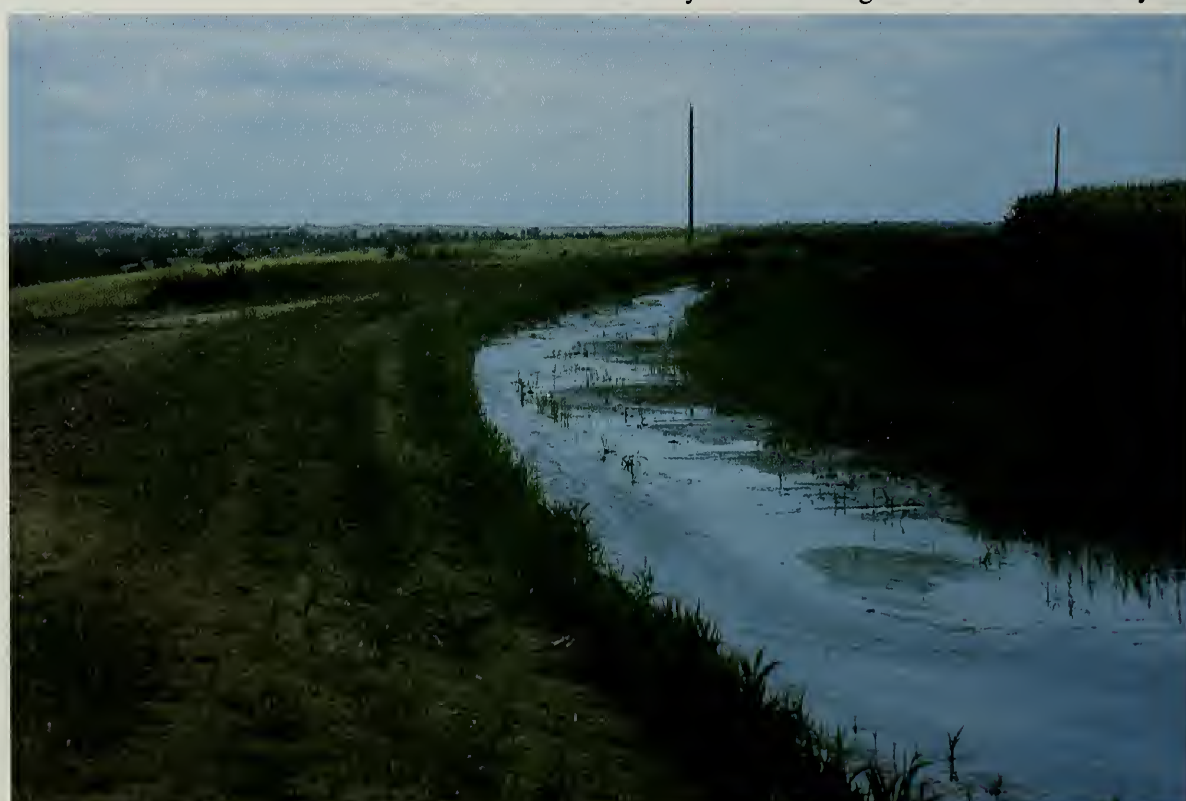
Small Dams Installed, 1985

Drainage Area Revegetated

BMP System
BMP 13 Improving an Irrigation and/or Water Management System
BMP 5 Diversion System

BMP 13 — Tailwater Recovery

BMP 5 — Diversion System Diverting Tailwater To Recovery Pit



BMP 13 — Improving an Irrigation and/or Water Management System

Tailwater Recovery System — Pit and Pump

Tailwater Recovery System — Pumping Tailwater Back Onto Field

BMP System
BMP 12 Sediment Retention, Erosion or Water Control Structure
BMP 13 Improving an Irrigation and/or Water Management System

Tailwater Recovery and Dam Structure to Stabilize Drainage

Grade Stabilized Below Structure

Streambank Vegetation

Reed Canarygrass Introduced And Adapted To Streambanks

Native Prairie Cordgrass Along Streambank

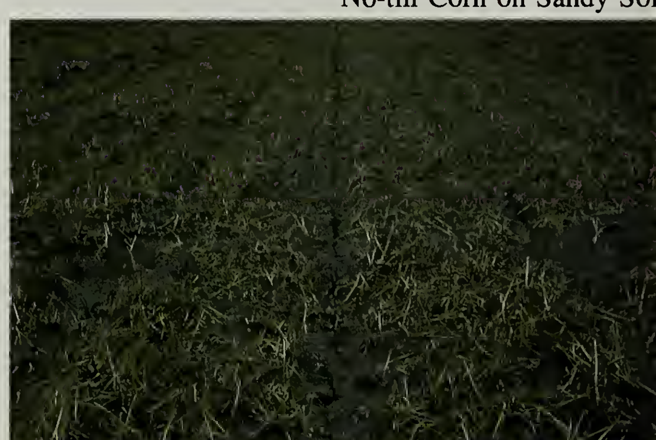
Conservation Tillage Experiments

No-till Corn Into Corn Residue

Ridge-Till Corn into Corn Residue

No-till Corn Into Rye Cover

No-till Corn on Sandy Soil



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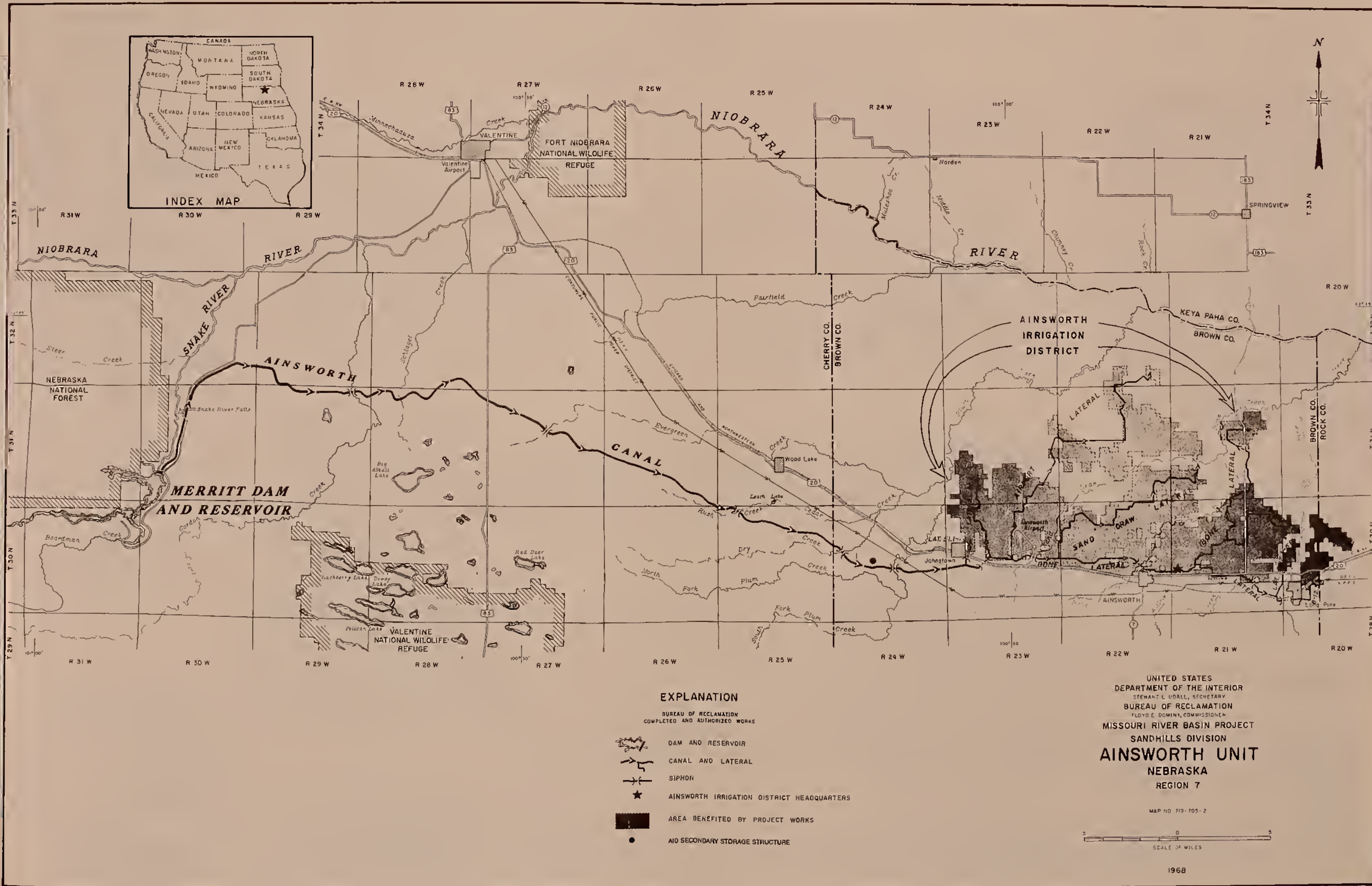
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WASHINGTON
MONTANA
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OREGON
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NEVADA
UTAH
COLORADO
KANSAS
CALIFORNIA
ARIZONA
NEW MEXICO
OKLAHOMA
TEXAS
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NIOBRARA
RIVER
SNAKE RIVER
AINSWORTH CANAL
MERRITT DAM AND RESERVOIR
NEBRASKA NATIONAL FOREST
VALENTINE
Valentine Airport
FORT NIOBRARA NATIONAL WILDLIFE REFUGE
VALENTINE NATIONAL WILDLIFE REFUGE
Wood Lake
Johnstown
AINSWORTH
Long Pine
Norden
SPRINGVIEW
CHERRY CO.
BROWN CO.
KEYA PAHA CO.
BROWN CO.
ROCK CO.
AINSWORTH IRRIGATION DISTRICT
LATERAL
SAND DRAW LATERAL
BONE LATERAL
Snake River Falls
Big Alkali Lake
Red Deer Lake
Pelican Lake
Rush Creek
Plum Creek
North Fork
Fairfield Creek
Evergreen
Minnechaduza Creek
Boardman Creek
Gordon Creek
Steer Creek
Schlagel Creek
R 31 W
R 30 W
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R 20 W
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N
EXPLANATION
BUREAU OF RECLAMATION COMPLETED AND AUTHORIZED WORKS
DAM AND RESERVOIR
CANAL AND LATERAL
SIPHON
AINSWORTH IRRIGATION DISTRICT HEADQUARTERS
AREA BENEFITED BY PROJECT WORKS
AID SECONDARY STORAGE STRUCTURE
UNITED STATES
DEPARTMENT OF THE INTERIOR
STEWART L. UDALL, SECRETARY
BUREAU OF RECLAMATION
FLOYD E. DOMINY, COMMISSIONER
MISSOURI RIVER BASIN PROJECT
SANDHILLS DIVISION
AINSWORTH UNIT
NEBRASKA
REGION 7
SCALE OF MILES
1968
GPO 843-485

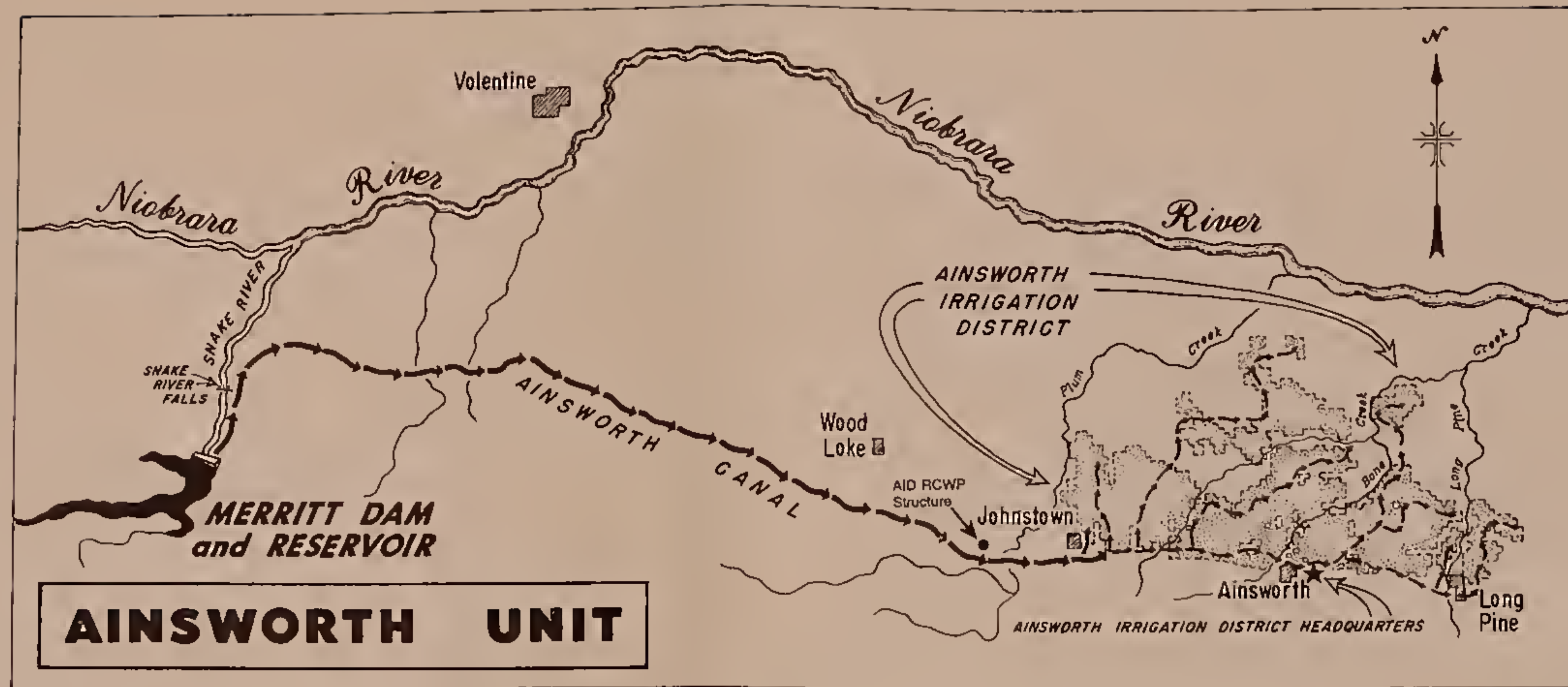
FACTUAL DATA ON THE

AINSWORTH UNIT

The AINSWORTH UNIT is in Cherry, Brown, and Rock Counties in north-central Nebraska. It is multipurpose and provides for irrigation, recreation, fish and wildlife enhancement and pollution abatement. The water supply comes from the Snake River and is stored in Merritt Reservoir for timely release into the Ainsworth Canal. Project facilities include Merritt Dam and Reservoir, Ainsworth Canal, and a system of laterals and drains to serve 33,960 acres of project lands.

WATER SUPPLY AND REQUIREMENT

The Snake River originates in the Sandhills region of Nebraska, an area characterized by highly permeable sands and many closed basins. Precipitation falling into these basins seeps into the ground or ponds temporarily, and feeds the streams with a large steady base flow. Because of the underground flow, the total drainage area contributing to the Snake River above Merritt Dam is about 600 square miles. Of this, only 83 square miles contributes surface runoff. Average annual runoff was 184,600 acre-feet for the period 1947-1962. Average annual irrigation diversion requirement to provide a full supply for the 33,960 irrigable acres is 102,000 acre-feet.



FEATURES OF THE PROJECT PLAN

MERRITT DAM is on the Snake River 14 miles upstream from the confluence of the Snake and Niobrara Rivers and about 26 miles southwest of Valentine. The earthfill dam rises 121 feet above the streambed and has a crest length of 3,222 feet. It is unique in that it is the first Bureau of Reclamation earthfill dam to use soil cement instead of rock riprap to protect its upstream face.

The morning-glory type ungated spillway protects the dam from damage by floods. A branched outlet works provides for diverting water to the Ainsworth Canal or for controlling releases to the Snake River through the spillway stilling basin.

Initial capacity of MERRITT RESERVOIR is 74,500 acre-feet—1,600 dead storage, 5,200 inactive, and 67,700 active conservation.

The AINSWORTH CANAL originates at Merritt Dam outlet works and extends eastward through the sandhills to the project lands. It is concrete lined for its entire length to minimize seepage losses in the sandy soils it traverses. An extensive lateral system delivers water to the irrigable lands.

Five miles of surface water disposal drains and several disposal ponding areas have been constructed. Other surface water disposal and subsurface drainage facilities will be constructed as necessary.

IRRIGATION

The irrigable lands are located in Brown and Rock Counties, generally north of U. S. Highway 20, and extending from Johnstown to Long Pine. Elevations of the irrigable areas range from 2,300 feet to 2,600 feet above mean sea level. The irrigation season is from about mid-May to mid-September.

CHARACTER OF SOILS

Lands in the unit lie in the western edge of the Chernozem soil belt. For the most part the soils are developed on loessal parent material which is underlain by sand and gravel at depths ranging from 3 to 6 feet. Principal characteristics of the mature soils are about 15 inches of dark colored sandy loam top soil containing a large quantity of organic matter giving way to a friable subsoil layer varying in texture from loamy fine sand to silt.

Land surfaces are nearly level to gently sloping, or gently undulating. The infiltration rates of the surface soils are moderately rapid. However, they have sufficient water-holding capacity and natural fertility for excellent production under irrigation.

WATER QUALITY CONTROL

Bone Creek receives effluent from the Ainsworth sewage treatment plant and some minor pollution abatement benefits accrue because of increased flow in that stream.

CLIMATE

Average annual precipitation for the period of 1928 through 1967 was about 21 inches with extremes from 12 to 37 inches. Approximately 75 percent of the precipitation occurs during the growing season but does not, however, fall in a pattern compatible with the needs of the crops. Temperature extremes on record are — 33 degrees and 112 degrees Fahrenheit. The frost-free period averages 146 days.

PRINCIPAL PRODUCTS

Principal crops being irrigated are feed grains, alfalfa, and small grains. Feed grains are utilized locally to augment a thriving and expanding livestock-feeding industry. Principal export of the project is livestock.

PRINCIPAL MARKETS

Livestock terminal markets are Omaha, Nebraska and Sioux City, Iowa. Small grains move to national markets after being processed in the midwest. Excellent rail and highway facilities serve the area.

OPERATION

Merritt Dam and Reservoir, the Ainsworth Canal, and the laterals and drains are operated and maintained by the Ainsworth Irrigation District.

RECREATION AND FISH AND WILDLIFE

An all-weather road built to facilitate project construction and operation provides easy access to Merritt Reservoir as well as picturesque Snake River Falls and the downstream section of the Snake River.

Improvement of upland game bird habitat has increased the number of game birds in the area and the reservoir water surface attracts great numbers of waterfowl. Several varieties of game fish have been stocked in the reservoir.

Opportunities for boating, water skiing, camping and picnicking are plentiful during the warm summer months at Merritt Reservoir. Picnic and sanitary facilities, parking areas, and boat ramps have been provided to facilitate outdoor recreation. Eight miles of all-weather two-lane road were built to insure access to the recreation and fish and wildlife facilities.

The Nebraska Game and Parks Commission administers recreation and fish and wildlife aspects of Merritt Reservoir. If additional information is desired on these aspects, contact the Commission at Lincoln, Nebraska 68509.

Address all inquiries regarding additional information concerning this Unit to:

REGIONAL DIRECTOR, REGION 7
BUREAU OF RECLAMATION
BLDG. 20, DENVER FEDERAL CENTER
DENVER, COLORADO 80225

PROJECT FEATURE DATA

MERRITT DAM AND RESERVOIR

Dam

Type	Zoned Earthfill
Crest Elevation (Feet)	2956.0
Height of Embankment (Feet)	121
Structural Height (Feet)	126
Hydraulic Height (Feet)	111
Length of Crest (Feet)	3,222
Width of Crest (Feet)	30
Base Width (Feet)	680
Volume of Embankment (Cubic Yards)	1,548,000

Reservoir (Initial Conditions)

Dead Storage, Elev. 2835.0 to 2875.0 (Acre-Feet)	1,600
Inactive Storage, Elev. 2875.0 to 2896.0 (Acre-Feet)	5,200
Active Conservation Storage, Elev. 2896.0 to 2946.0 (Acre-Feet)	67,700
Total Capacity to Elev. 2946.0 (Acre-Feet)	74,500
Surcharge Capacity, Elev. 2946.0 to 2949.8 (Acre-Feet)	11,600
Surface Area at Elev. 2946.0 (Acres)	2,906
Shoreline Length at Elev. 2946.0 (Miles)	44

Spillway

Uncontrolled morning-glory type with concrete conduit, chute, and stilling basin.

Crest Elevation (Feet)	2946
Capacity at Water Surface Elev. 2949.8 (c.f.s.)	2,05[illegible]

Outlet Works

Conduit through base of dam with branches at [illegible] end to serve the Ainsworth Canal and the river.

CANALS, LATERALS, AND DRAINS

Ainsworth Canal

Length (miles)	[illegible]
Initial Capacity (c.f.s.)	[illegible]
Acres Served	[illegible]

Laterals

Total Length (miles)	[illegible]
Initial Capacities (c.f.s.)	[illegible]
Acres Served	[illegible]

Drains

Surface, Constructed (miles)	[illegible]

Additional surface water disposal and subsurface drainage facilities will be constructed as necessary.

EXECUTIVE SUMMARY

In 1981, the Long Pine Creek Watershed was one of 21 watersheds in the United States selected for the experimental Rural Clean Water Project (RCWP).

The Long Pine Creek Watershed is located in north central Nebraska on the northeastern edge of the Nebraska Sandhills, the only grass covered sand dune area in the world. The Sandhills rest upon the Ogallala Aquifer, a 200 mile wide corridor of underground water that extends south through Kansas and Okalahoma into Texas.

The watershed is drained by Long Pine Creek, the longest self-sustaining trout stream in Nebraska. The creek and its tributaries provide over 79 miles of winding stream in a rugged wildlife setting. It's natural beauty and recreational and wildiife importance makes it one of Nebraska's treasures.

The watershed encompasses 325,000 acres of rolling plains and flat tablelands with deep cut canyons and draws. The area is sparsely populated and supports ranching and farming with no major industry. The Ainsworth Irrigation District brought irrigation to 35,000 acres in the mid 1960s. Farmers focus mainly on irrigated corn production with some production of popcorn, soybeans, and alfalfa.

The watershed was identified as having severe surface and groundwater problems in the late 1970s. The nitrate-nitrogen content in municipal and domestic water supplies was beginning to exceed maximum contamination standards. Pesticide contamination of ground and surface water was becoming apparent. Sediment from agricultural runoff and erosion was filling creeks and streams and seriously degrading trout habitat. The bacterial content in surface waters was posing a health hazard to humans and wildlife.

In 1981, the Agricultural Stabilization and Conservation Service (ASCS), with the assistance of the Soil Conservation Service (SCS), the Nebraska Game and Parks Commission (NGPC), the Middle Niobrara Natural Resource District (MNNRD), and the Cooperative Extension Service (CES) applied for the Rural Clean Water Project. The watershed was chosen for the project. $1.3 million was allocated for cost-share funds to implement Best Management Practices (BMPs) designed to control nonpoint source (NPS) pollution. NPS pollution is pollution coming from a nonspecific site, such as agricultural runoff. Point source pollution originates from a specific, identifiable site.

The RCWP emphasized interagency cooperation at the state and federal level. The program was administered through ASCS. A Local Coordinating Committee (LCC) consisting of members of 15 agencies and groups was responsible for implementing the program. LCC members had not previously worked on an experimental project of this length and magnitude. The LCC had to identify critical areas, establish goals, assign responsibilities, determine priorities and oversee and direct all activities of the project. There were many differing opinions.

Fifteen BMPs were selected to address NPS problems on 60,242 acres determined as critical and targeted for treatment. Cost-shares were used to encourage farmer participation.

Information and Education (I&E) responsibilities were given to the CES. Farmers had to be encouraged to enroll in the program. Even though most BMPs were cost-shared at 75% of installation costs, many farmers had a difficult time financing the 25% for which they were responsible. Contracting was difficult throughout the early 1980s due to a depressed agricultural economy. Contracts were eventually written on 42,832 acres (71% of the critical area).
Responsibility for BMP 15, Residual Nitrate Management and BMP 16, Pesticide Management was also given to the CES. These practices reduced fertilizer and pesticide applications without sacrificing yields. Production costs were immediately reduced. These practices were so successful that they were adopted by farmers throughout the watershed. A farmer-operated Integrated Pest Management Association (IPM) was established and continues to operate today. A demonstration farm, initiated by the CES through RCWP, also continues.

The SCS was responsible for the technical assistance for all other BMPs. Many practices required a great deal of time for site selection, design, and survey activities. The SCS had to write a Water Quality Plan on

each participating farm. The water quality plan incorporated combinations of BMPs to address the NPS problems on each particular farm. The water quality plans were routinely modified as experience and expertise in dealing with NPS problems grew.

Many agencies were drawn into the project and made significant contributions. The North Central Nebraska Resource Conservation District (RC&D) installed six Critical Area Treatments (CATs) along roadsides that were significantly degrading the area. The county agreed to maintain the CATS.

The MNNRD installed grade stabilization structures (gabion rock structures) at the headwaters to address a serious headcutting problem. The SCS, MNNRD and CES assisted the Nebraska Department of Environmental Control (NDEC) in collecting water quality monitoring samples.

The NGPC allocated funds to pay for the producer's portion (25% of installation costs) for practices that provided wildlife benefits. Most of the practices were for streambank stabilization measures that proved to be very successful. The Ainsworth Irrigation District (AID) provided machinery and labor for the installation of the secondary storage reservoir.

The NDEC was given responsiblity for water quality monitoring throughout the project. This involved both ground and surface waters. Monitoring was planned in three phases, Pre-Implementation, During Implementation and Post-Implementation. The NDEC had already begun an intensive water quality monitoring project in the watershed in 1979. This project continued through 1985 and provided the baseline data that is needed in order to determine the project's effectiveness. A three year post-monitoring project is scheduled to begin in 1992. Data will be compared with the pre-implementation data in order to evaluate BMPs effectiveness and the effectiveness of the project in general.

A total of $857,540 in cost-share assistance was expended through RCWP as of April, 1991. Over half of the funds were utilized for BMP 13-Irrigation and/or Water Management practices. Other BMPs widely installed were BMP 6-Grazing Land Protection System, BMP 12-Sediment, Retention, Erosion or Water Control Structures, BMP 5- Diversion System and BMP 10- Stream Protection System.

Difficulties surrounding the project involved organization, assessment of NPS pollution, critical area identification, data documentation, priority determination, and a lack of personnel devoted solely to the project.

Throughout the past decade of RCWP development and application, technicians have gained a great deal of knowledge regarding water quality and BMP application. Projects have accumulated a wealth of information about BMPs and their relationship to point and NPS pollution. This information must be shared and further incorporated into other water quality projects. Each RCWP project is a valuable resource. RCWP watersheds should be utilized as educational centers for technical personnel in all agencies.

CHAPTER 1—PROJECT FINDINGS AND RECOMMENATIONS

Many valuable lessons were learned throughout the decade of RCWP activity. Difficulties surrounding the project involved organization, critical area identification, priority determination, data collection, insufficient personnel devoted solely to RCWP activity, and a good understanding of NPS pollution.

At the beginning of each project, a sufficient amount of time must be devoted to project orientation. The Local Coordinating Committee (LCC) members and members of all agencies that will be involved in the project must take the necessary time to acclimate themselves to the project. There must be a good understanding of NPS pollution. Critical areas, subbasins and priorities need to be determined before goals can be established. Many of these will change with project development. There must be room for an experimental project of this length and magnitude to evolve.

As many as 15 agencies may be involved in the project at various stages of development. A project coordinator is necessary to give direction and keep the project moving. An atmosphere of collaboration and teamwork must be cultivated within the LCC. In order to cultivate a better understanding of the project's development and direction, the LCC must work closely with the State Coordinating Committee (SCC). The SCC needs to be involved in the on-going discussion and problem solving that takes place at the LCC level.

Adequate personnel at all levels need to be assigned to the project. Procedures for the documentation of critical areas, subbasins, and land treatment data must be established before implementation begins.

The following project findings and recommendations are organized by chapter. For a further explanation or discussion of each item, refer to the appropriate chapter.

<u>**Goals and Objectives - Chapter 2**</u>

*In order to establish realistic goals and objectives there must be a clear understanding of the RCWP program and of nonpoint source pollution. Goals should center around the national objectives of the project.

*Goals and objectives are likely to evolve with project development.

*Initial goals and objectives for implementation cannot be made until specific information and data are studied. For example, the critical area needs to be clearly defined and the water quality problems and problem areas fully understood before realistic implementation goals can be set. Implementation goals must be specific, (i.e. defined by practice and location).

*Economic evaluation goals and objectives need to be incorporated into the project.

*I&E goals and objectives often go hand in hand with CES projects and objectives. When full responsibility for I&E is given to the CES to coordinate with their activities, I&E is effective.

*Water quality monitoring goals and objectives should not be underestimated. Without appropriate pre- and post-monitoring projects, the proper evaluation of a project cannot be made.

*Federal farm programs that regulate feed grain production can effect land use patterns and water resource management throughout the project period. These will have to be taken into consideration when adjusting goals and objectives.

Implementation Results - Chapter 3

Many valuable lessons were learned during the 10 years of development and application of BMPs within the Long Pine watershed. Most fall into the following categories:

1. Implementation Highlights
2. Implementation Difficulties
3. Critical Area Definition
4. Establishing Priorities
5. Documentation of Technical and Cost-Share Data
6. Assessment of nonpoint source pollution
7. Initiating innovative, experimental practices
8. Uniformity of Data Reporting
9. Technical Personnel Lessons Learned

1. Implementation Highlights:

*Ainsworth Irrigation District Secondary Storage Structure: Completed in 1987, the reservoir diverts irrigation water from a 53 mile long canal immediately following heavy rains. Irrigation water shutdown time decreased from 24-48 hours to 6-8 hours.

*Cedar Revetments were one of the most innovative and successful practices implemented. Constructed for streambank stabilization, they provided a variety of habitat benefits to trout and other aquatic life.

*Fertilizer and Pesticide Management practices, developed by the CES, were widely adopted outside the critical area. As a result, significant reduction in fertilizer and pesticide use has been achieved.

*Over half of all cost-share funds were allocated to BMP 13, Improving an Irrigation and/or Water Management System. (21.8% was for the AID storage structure and 29.5% was for tailwater recovery systems).

*Emphasis on BMP Systems (practices that work together to achieve specific goals) better address overall problems than emphasis on individual practice installment. Systems often combined noncost-share practices with cost-share practices.

*Knowledge and experience gained by technicians working with RCWP can be applied to other water quality projects.

2. Implementation Difficulties:

Implementation difficulties were:

*National priority given to other USDA programs during peak years of BMP implementation specifically Highly Erodible Land (HEL) determinations, the Conservation Reserve Program (CRP) from 1985 to 1989, and wetland determinations (1987). These negatively affected BMP implementation.

*Time consuming design and approval procedures for practices under BMP 2 delayed implementation.

*Selection of appropriate locations for many practices, especially diversion systems, was difficult.

*Scheduling of work. Many practices required extensive spring or fall work. If for any reason work could not begin in a timely manner, practices were delayed until the following year.

*There were insufficient ASCS and SCS personnel devoted solely to the RCWP at the beginning of the project.

*The inability to fund feedlots considered point sources.

*The inability to address streambank erosion along Sand Draw and Bone Creeks Irrigation changed the hydrologics of the area which accelerated the natural erosion of the streambanks. Revetments and other stabilization practices were not readily applicable to these areas. Additional funds for a proposed structure on Sand Draw were not approved.

*Lack of direction and guidance from state and national levels.

3. Critical Area Definition:

*The critical area to be targeted for treatment needs to be clearly defined and designated from the beginning of a project. Some basic guidelines are needed to assist in determining the critical area. As this area is likely to change as the project evolves, permanent documentation of acres and changes need to be made.

4. **Establishing Priorities:**

*Once the critical area is firmly established, clearcut priorities need to be assigned in order for the implementation process to have direction. Priorities could be assigned by subbasin, by area or by practice, based on the watershed's most immediate need. The SCS and other agencies with technical expertise should determine priority needs. An annual review of priorities combined with a status report on each priority project would help focus on the direction of the project and assist in determining the next year's priorities.

5. **Documentation of Technical and Cost-Share Data:**

*The RCWP program emphasized interagency cooperation at the State and Federal level with as many as 15 agencies involved in some capacity at various stages of the project. In order to provide continuity and a base of consistent information, procedures for the documentation of technical and cost-share data need to be established.

6. **Assessment of Nonpoint Source Pollution:**

*The LCC did not have a good understanding of NPS pollution. Therefore much time was spent focusing on point source pollution problems. At the beginning of a project of this nature, members of the LCC and all agencies involved should attend an orientation seminar where NPS pollution is explained in detail and where a format for organization, critical area selection and prioritization are presented.

7. **Initiating Innovative, Experimental Practices:**

*The project lacked a format for designing and employing experimental practices. It is generally felt by technicians and others working on the project, that support from upper levels was lacking for innovative and experimental practices that were already being implemented in other RCWP projects.

8. **Uniformity of Data Reporting:**

*"Acres Served" and "Units Applied" data is currently being used in conjunction with water quality monitoring data to determine (1) BMP effectiveness and (2) land treatment accomplishments. This data is not consistently reported. If acres served data is to be used to make determinations of a practice's

cost-effectivenss or of its effectiveness, in general, this data must be uniformly reported. SCS should establish criteria for the reporting of acres served for each practice code.

9. Technical Personnel Lessons Learned:

*A certain amount of time is needed at the beginning of the project to prepare a comprehensive plan with clear objectives and goals before Water Quality Plans can be written or any BMP implmentation begins.

*An overall understanding of the project is needed in order to design BMP systems;

*An overall understanding of each farm operation is needed in order to design BMP systems;

*An adequate amount of technical staff devoted solely to RCWP is necessary. There is need for a project coordinator; a project planner (with incentives to GS-11 to encourage the planner to stay with the project); and a project engineer.

*Technical innovations initiated in each RCWP project should be shared.

*The SCS will spend more personal time with each producer than any other agency. This contact is important in developing a producer understanding of (1) BMP systems and (2) each producer's responsibility for BMP maintenance.

*More authority should be given to the Technical Committee.

*Once goals are established they should be followed.

*The SCC and area offices need to be totally committed to the project and provide leadership, support and assistance to the LCC and local offices.

*Orientation needs to take place for SCS planners and engineers coming into the project.

*LCC should have more decision making power.

*More acceptance of experimental practices is needed. A lot can be learned from them, even if they do not achieve specific goals.

*Each RCWP project is unique and provides each state with a valuable resource. Each project has accumulated a vast amount of knowledge about BMPs and their relationship to point and NPS pollution. RCWP watersheds should become educational centers for technicial personnel in all agencies.

Information and Education - Chapter 4

*CES is a valuable resource base.
*I&E is effective when responsibility is given to one agency.

*I&E goes hand in hand with CES objectives.

*When economic advantages of BMPs are stressed, practices are widely adopted.

*Interest can be generated throughout the community and take off on its own, such as with the IPM Assn. and Demonstration farm.

*Field demonstrations are a powerful tool to use to communicate with producers.

*Technical funds need to be allocated for I&E activities.

<u>**Institutional Relationships and Economics - Chapter 5**</u>

Institutional Relationships and Economics F&Rs fall into seven main categories:

1. Institutional Relationship Highlights
2. The need for a Project Coordinator
3. SCS and ASCS-Additional Personnel
4. Establishment of a point source committee
5. SCS/LCC Interaction
6. Economic Evaluation - Data Log
7. Return of Cost-Share Funds

1. Institutional Relationships Highlights:

*State agencies such as NG&P, MNNRD and RC&D were brought into the project and contributed greatly to the project's success.

*Water Quality Monitoring involved collecting hundreds of samples and sending them in for analysis. The logistics of the watershed presented problems. The SCS, MNNRD and CES worked closely with the NDEC in collecting samples throughout the project period.

2. Project Coordinator:

*A project coordinator is of utmost importance in a project of this size and length. Throughout the decade of RCWP activity, there were many years when the efforts of all agencies were drawn toward other programs which were assigned immediate priority. A project coordinator is necesssary to

move the project ahead during these difficult times, to maintain the continuity of the program and to keep the program focused to goals, objectives and priorities.

3. SCS and ASCS Personnel:

*SCS needs to provide a project planner and a project engineer until the majority of practices have been completed. ASCS needs to provide a full-time program assistant to RCWP for at least as long as the contracting is underway.

4. Point Source Committee:

*The LCC needs to create a Point Source Committee. This committee would devote itself to point source problems. The LCC had a difficult time separating NPS problems from point source problems.

5. SCC/LCC Relationship:

*The SCC and LCC need to interact to a greater degree for mutual understanding. The SCC should be involved in some of the hands-on negotiations and problem solving at the local level.

6. Data Log:

*A log needs to be established to record technical and economic data (by individual BMP practice), throughout the life of the project.

7. Return of Cost-Share Funds

*In 1990 the LCC returned RCWP cost-share funds to Washington that they felt would not be needed. Within a year, additional funds were necessary to complete RCWP practices. Although the funds were obtained, it is generally felt that cost-share funds should not be returned until all of the practices are completed.

Monitoring Program Design - Chapter 6

*Monitoring programs should be holistic. Consideration should be given to water quality, habitat quality, biotic integrity, water quality, land treatment, and land use.

*It is critically important that a monitoring project plan be prepared which clearly defines how the monitoring program will be implemented, and how the effectiveness of the project will be evaluated. The plan should include: 1) clearly and narrowly defined monitoring objectives; 2) a project description which identifies the monitoring network design and rationale, the parameters to be monitored, and their frequency and method of collection; 3) monitoring fiscal information; 4) a schedule of tasks and products; 5) personnel responsibilities; 6) data management provisions; 7) reporting requirements; and 8) appropriate quality assurance/quality control provisions.

*Monitoring should allow for water quality assessment by hydrologic units. A "paired watershed" or "up-stream-downstream" monitoring design should be used whenever possible.

*Extensive monitoring using a "laundry-list" approach should be avoided. Relationships should be discerned between NPS pollutants and loadings and their impacts on beneficial uses. These relationships should be used to identify critical parameters, including covariates, for monitoring.

*Direct measures of beneficial use support (e.g. aquatic biota occurence, embryo survival, etc.) should be used whenever possible. The use of such information may require utilization of reference sites.

*Variability attributed to flow and seasonality are often ignored in monitoring water quality. These sources of variability are important in assessing water quality and must be accounted for to the degree possible.

*BMP effectiveness monitoring is important in that it provides feedback to project participants and it allows the success of BMPs implemented as part of the project to be evaluated.

*Land treatment and land use information should be tracked by hydrologic units to facilitate evaluation of BMP effectiveness. Procedures for documenting land use and land treatment data must be established and a database maintained.

*Land use and land treatment within the project area, both participants and nonparticipants, should be tracked in the land treatment database. Land treatment data tracking should not end with contract expiration if the project is still ongoing.

*Water quality monitoring and watershed evaluation results should be used by resource managers as much as possible to identify critical areas and in selecting and prioritizing BMPs.

CHAPTER 2—PROJECT BACKGROUND

Overview of the Rural Clean Water Project

The Rural Clean Water Program (RCWP) is a federally-sponsored program designed to control agricultural nonpoint source (NPS) pollution in rural watersheds with the goal of improving water quality. Initiated in 1980, the RCWP was established as a 10-15 year experiment offering cost-sharing and technical assistance as incentives for voluntary implementation of Best Management Practices (BMPs).

The objectives of RCWP are to:

*Achieve improved water quality in the approved project area in the most cost-effective manner possible in keeping with the provision of adequate supplies of food, fiber, and a quality environment;

*Assist agricultural land owners and operators to reduce agricultural NPS water pollutants and to improve water quality in rural areas to meet water quality standards or water quality goals; and

*Develop and test programs, policies, and procedures for the control of agricultural NPS pollution.

With a total appropriation of $64 million, the RCWP has funded 21 watershed projects across the country. These projects represent a wide range of pollution problems and impaired water uses. The RCWP projects were selected from state lists of priority watersheds developed during the Section 208 planning process under the 1972 Clean Water Act. Projects are located in Alabama, Delaware, Florida, Idaho, Illinois, Iowa, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Nebraska, Oregon, Pennsylvania, South Dakota, Tennessee/Kentucky, Utah, Vermont, Virginia and Wisconsin.

While water quality monitoring has been performed in all 21 projects, five of the RCWP projects (Idaho, Illinois, Pennsylvania, South Dakota, and Vermont) were selected to receive additional funding for comprehensive monitoring and evaluation.

Each project involves both land treatment and water quality monitoring. Landowners were contracted to implement BMPs, with the length of the contract depending on the practice being implemented - typically three years minimum (e.g., conservation tillage) and ten years maximum (e.g., terraces, animal waste management systems).

Most RCWP project contracts began in 1980-81 and ended in 1986, with project results currently being evaluated. The RCWP program will terminate in 1992; however, a few individual projects have been extended until 1995.

The RCWP is administered by the U.S. Department of Agriculture's Agricultural Stabilization and Conservation Service (ASCS). Based on the principle of interagency cooperation and the existing federal/state/local partnership, the RCWP is also assisted by other federal agencies, including the Soil Conservation Service (SCS), Environmental Protection Agency (EPA), Cooperative Extension Service (CES), Forest Service (FS), Agricultural Research Service (ARS), Economic Research Service (ERS), and Farmers Home Administration (FMHA), as well as many state and local agencies.

Both direct water quality benefits and a wealth of experience in agricultural NPS pollution control have resulted from the RCWP. Results and lessons learned from RCWP projects constitute an important source of information for other federal and state NPS pollution control programs. The program has also helped to define research needs and has increased public awareness of this important water quality problem.

The following report constitutes a 10-year report on one of the 21 RCWP watershed projects. Each 10-year report describes the watershed project undertaken, monitoring conducted, results as of 1991, and recommendations.

These 10-year reports, other project data, and on-site project evaluations will provide the basis for a final summary and evaluation of the entire RCWP to be prepared by the National Water Quality Evaluation Project (NWQEP) by the end of 1992. Finally, some of the projects that have been extended past 1991 may also publish addendum reports.

Project Background

The Long Pine Creek Watershed was identified as having severe surface and groundwater problems in the late 1970s. Water quality monitoring studies, conducted by state and federal agencies during the 1960s-1970s, revealed a steady deterioration of ground and surface waters throughout the watershed. By the late 1970s a number of health and enviornmental problems had surfaced.

*The nitrate-nitrogen content in municipal and domestic water supplies was beginning to exceed maximum contamination standards.

*Pesticide contamination of ground and surface water was becoming apparent.

*Sediment from agricultural runoff and erosion was filling creeks and streams and seriously degrading trout habitat.

*The bacterial content in surface waters was posing a health hazard to humans and wildlife.

Local citizens, along with state and national health and environmental agencies, were beginning to express serious concern for the area.

The Long Pine Watershed borders the northeastern edge of the Nebraska Sandhills, the only existing grass covered sand dune area in the world. The Sandhills can rise 400 feet and then drop below the ground water level, creating many wetland areas. Soils are easily eroded and highly permeable. The Sandhhills rest upon the Ogallala Aquifer, a 200 mile wide corridor of underground water that extends south through Kansas and Oklahoma into Texas. This aquifer provides groundwater which is the main source of water for many uses in the area.

The watershed area encompasses 325,000 acres of rolling plains and flat tablelands with deep cut canyons and draws. The creeks and streams are lined with cedar, pine, willow, scrub oak, ash and cottonwood trees. They wind through narrow valleys deeply eroded into the tablelands. Surface elevations range from 2,700' to 1,930' in the stream channel. Much of Long Pine Creek and its tributaries are not easily accessible.

The area supports farming and ranching with virtually no major industry. There are approximately 6,000 acres of commercial forestland within the watershed. The majority of this timber is located on stream terraces and steep slopes near major waterways.

The area is somewhat remote. Ainsworth and Long Pine are the only towns located in the watershed area. In 1980 approximately 2,200 people resided in Ainsworth and 600 in Long Pine. By 1990 the population had been reduced to 1,870 in Ainsworth, and 396 in Long Pine, with the total population of Brown County at 3,792.

The watershed is drained by Long Pine Creek, the longest self-sustaining trout stream in Nebraska. The creek represents 54% of Class I coldwater streams in Nebraska and provides 10.5% of the state's total trout spawning habitat. Long Pine Creek and its tributaries are inhabited by three fish species which have been identified as threatened in Nebraska. The creek and its tributaries provide over 79 miles of winding stream in a rugged wildlife setting. It's natural beauty and recreational and wildlife importance makes it one of Nebraska's treasures.

Originally settled in the mid to late 1800s, the area supported ranching and a small amount of dryland farming. The native grass cover of sand, big and little bluestem, switchgrass, indiangrass and prairie sandreed grass provided excellent grazing for livestock.

In the late 1940s a large segment of the population pursued the possibility of developing the area for irrigation. In 1946 the Bureau of Reclamation began a comprehensive study of the land and water resources of the Niobrara River Basin. The bureau recommended that four units be considered for development. The Ainsworth Unit was one of them. In 1954 the Ainsworth Unit was authorized as part of the Missouri River Basin Project under PL 612 (68 Stat. 757). Construction of Merritt Reservoir was completed in 1964 and irrigation began in 1966.

The Ainsworth Irrigation Project brought irrigation to 35,000 acres located within the watershed. Most of the land had previously not been farmed or irrigated. The sudden change from grasslands to intensive row crop production had enormous economic and environmental impacts on the area. The economy boomed. All cropland was to be gravity irrigated and therefore had to be leveled. Machinery, seed, fertilizers and fuel were needed on a massive scale. Land values increased dramatically. The area enjoyed an extended period of prosperity.

A variety of crops were originally planted. However, within a few years farmers focused mainly on cash crop corn production. A small amount of irrigated alfalfa was grown. The extensive use of chemicals was introduced. Annual fertilizer usage in the late 1970s was 180-220 pounds of nitrogen, 30-35 pounds of phosphate, and, 50-60 pounds of potassium per acre. A variety of pesticides and herbicices were also being extensively used throughout the area.

Average rainfall is 21.5 inches. This comes mostly from high intensive, short duration thunderstorms which occur from May through August. Runoff from a severe storm can remove up to 100 tons of soil per acre. Heavy irrigation practices beginning in the mid 1960s placed an additional 16 inches of water onto some 35,000 acres of new cropland annually. The increase in agricultural runoff was formidable.

Whenever a shallow groundwater source and sandy soils exist in an area of intensive irrigated row crop production (where chemicals are widely used) the contamination of ground and surface water is inevitable. Rains fell on already saturated fields. Water ran off pastures, cropland and feedlots, removing topsoil, nutrients, pesticides and organic materials and carried them into water bodies.

This sudden abundance of water increased percolation to ground water and raised water tables. Hydrologic dynamics throughout the area were permanently altered. Water tables rose to such an extent that some tributaries that flowed only during storm events began to flow year around. This massive increase in runoff and stream flow resulted in streambank erosion on a major scale along some of the creek's tributaries.

Within a few years, an overwhelming amount of sediment was entering surface water areas. This had a negative impact on aquatic life along the creek and its tributaries. At the headwaters, excessive sediment settled into the slower flowing pools, reducing the depth of the channel and thus creating a wide, shallow and warmer stream, all of which are detrimental to trout species.

Aquatic insect populations, a valuable fish food source, began to decline. Sediment laden waters blocked sunlight to oxygen-producing plants. It was feared that the spawning habitat in some of the more productive reaches of the stream was being degraded. The stream's ability to sustain trout was seriously being questioned. In 1972 the Nebraska Department of Environmental Control (NDEC) ranked the Long Pine Creek Watershed fifth of 59 watersheds for protection and abatement of nonpoint source pollution.

Chemicals were found to be leaching into ground water throughout the area. Contamination of municipal supply wells in Ainsworth had steadily increased from 1969 to 1976. The State Health Department laboratory found that 17.5% of 23 domestic wells sampled in 1977-1978 contained nitrate-nitrogen contents that exceeded the maximum contamination level of 10 mg/1. One well contained 21 mg/1.

In 1981, the ASCS, with the assistance of the SCS, the Middle Niobrara Natural Resource District (MNNRD), the CES and other agencies, applied for the Rural Clean Water Project. The watershed was accepted into the program. Identified as primary sources of water pollution were cropland and rangeland runoff, livestock operations, irrigation return flow and roadside and streambank erosion.

Project Goals and Objectives

Findings and Recommendations:

Although goals and objectives were established for water quality, implementation, I&E, economic evaluation, and water quality monitoring, they were often difficult to follow. In establishing project goals and objectives, several things must be kept in mind:

*In order to establish realistic goals and objectives there must be a clear understanding of the RCWP program and of nonpoint source pollution. Goals should center around the national objectives of the project.

*Goals and objectives are likely to evolve with project development. Initial goals and objectives for implementation cannot be made until specific information and data are studied. For example, the critical area needs to be clearly defined and the water quality problems and problem areas fully understood before implementation goals can be set.

*Implementation goals need to be specific and directed toward the seriously degraded areas of the watershed or toward specific practice implementation priority.

*Economic evaluation goals and objectives were established, but not pursued. There was not a clear understanding of how to incorporate economic evaluation into the project.

*Information and Education (I&E) goals and objectives often go hand in hand with CES projects and objectives. When full responsibility for I&E is given to the CES to coordinate with their activities, I&E goals and objectives are efficiently achieved.

*Water Quality Monitoring Goals and Objectives should not be underestimated. Without appropriate pre- and post-monitoring, the proper evaluation of a project cannot be made.

*Federal farm programs which regulate feed grain production will effect land use patterns and water resource management throughout the project period. These programs will also effect RCWP participation as producers will first consider their feed grain program opportunities and then fit other USDA programs into their operation.

Water Quality Goals and Objectives

Objectives: In addition to the National RCWP objectives, the LCC identified three objectives of their own. The first and second were adopted in 1984, the third in 1987. They are:

*To improve the beneficial uses of ground and surface water in the project area. These include domestic, agricultural, industrial, recreational and cold-water fisheries.

*To plan, implement and evaluate BMPs that have been selected to improve water quality and beneficial uses of water in the project area.

*To develop new and innovative solutions to problems.

Goals: The first five goals were established in 1984. The fifth goal was then defined specifically to "reduce **point** source agricultural pollution from feedlots." In 1985 this was changed to **NPS** pollution. Item 6 was added in 1987. Items 7 and 8 were included in 1988. Specific goals established by the LCC were to apply BMPs that would:

1. Reduce streambank erosion;
2. Reduce the delivery of sediment from agricultural lands;
3. Reduce the deep percolation of irrigation water contaminated with fertilizers and pesticides;
4. Reduce the excess irrigation pollution from feedlots;
5. Reduce nonpoint source agricultural pollution from feedlots;

and in the process:

6. Educate the general public about the importance of water quality;
7. Develop positive community attitudes toward the importance of water quality; and,
8. Support and encourage the implementation of appropriate BMPs outside the project area.

One of the LCC's greatest disappointments in the early years of RCWP was the inability to approve cost-share funding for many of the feedlots in the watershed area.

According to the RCWP manual, an agricultural point source is defined as "farms with 1,000 or more animal units" or "portions of a farm for which EPA has issued a permit" Some of the feedlots in the watershed had over 15,000 animal units. They were under compliance schedules with the NDEC. In fact most of the feedlots located within the critical area fell into these categories and were therefore, as point sources, not eligible for cost-share funding through RCWP.

The LCC had a difficult time accepting this. It was felt that the ultimate goal of the improvement of water quality in the area could not be met unless these feedlots received cost-share assistance for the expensive livestock waste control facilities that were needed. In 1984, the LCC made one of its goals to reduce the point source pollution from these feedlots. LCC first attempted to seek a clarification of the RCWP rules that would allow for cost-sharing for the point source feedlots in the critical area. When that failed, LCC wrote a letter to the SCC and NCC requesting a waiver of the point source restriction on feedlots.

In 1984, NCC denied this request. SCC concurred with the NCC ruling. The RCWP program was a NPS pollution control program. The feedlots had been issued NDEC permits and were under compliance schedules with the NDEC for construction of required control systems. The feedlots were considered point sources and as such were ineligible for cost-share. This was a major disappointment for the LCC. The LCC continued to spend a great deal of time and effort trying to find other areas of funding for the feedlots. The LCC also considered rerouting Bone Creek in order to miss one of the feedlots.

In 1984, a RCWP interagency appraisal team performed an on-site appraisal of the Long Pine Creek project. They recommended that for the good of the project, the LCC drop efforts in behalf of the feedlots. Strong directives were given to the LCC to expend time and resources on priority practices that offered cost-share potential. In 1985, the LCC reluctantly discontinued their efforts to find funding to address the point-source feedlots.

Implementation Goals and Objectives:

Implementation Goals and Objectives centered around writing contracts (the goal was to have 75% of the critical area under contract within the first five years) establishing water quality plan objectives, and prioritization of the contracts.

Each request for participation had to be assigned a high or low priority based on specifications in the RCWP manual. After priority was determined, SCS staff had to write Water Quality Plans for each contract.

The Long Pine RCWP established objectives for each water quality plan. They were to:

*control storm water runoff;
*reduce soil loss to acceptable limits;
*Provide 80% trap efficiency of sediment water;
*reduce deep percolation of irrigation water;
*control tailwater runoff from irrigation systems;
*provide for livestock waste management;

After the water quality plan was written for a contract, priorities were established where BMPs could be applied to maximize improvements and beneficial uses. Individual contracts were identified as high and low priority. Contracts were considered high priority if one or more of the following applied:

*There was a significant amount of land with designated critical sources;
*The participant would be a contributor to a pooling agreement for one of the planned structures;
*There was active streambank erosion on the land;
*The RCWP contract would be essential to carryout stream protection activity in cooperation with the Nebraska Game and Parks Commission (NGPC);

The severity of the water quality problems that existed in specific areas throughout the watershed was continuously debated by the LCC. Originally, it was felt that the main problems stemmed from trouble at

the headwaters of Long Pine Creek. After geologic investigations, it was determined that streambank erosion along Sand Draw and Bone Creeks was more seriously contributing to the water quality problems than the headwaters. Priority areas to be targeted for treatment were never firmly established and continued to be ardently debated by LCC members. This hampered the establishment of clear-cut goals in the overall targeting of implementation.

Information & Education Goals and Objectives

The I&E goals and objectives were established early in the project and did not vary. The Cooperative Extension Service (CES) was given full responsibility for the development and implementation of all I&E aspects of the project. The objectives of the I&E subcommittee were to:

*Plan, prepare and present workshops and demonstrations to accomplish RCWP project objectives and goals;

*Coordinate the flow of project-related information from federal, state and local agencies to land users and the public in the project area;

*Survey land users' attitudes about the effectiveness of the I&E program and the RCWP;

Specific responsibilities assigned by the LCC to the I&E subcommittee were to:

*Develop the RCWP I&E program;
*Develop the I&E portion of the Annual Plan of Work;
*Coordinate the I&E plan with the other subcommittees;
*Conduct field tours and demonstration projects;
*Secure adequate media coverage;
*Perform other I&E duties that the LCC assigns;

The CES also established objectives of their own. They were to:

*Help area farmers and ranchers become more aware of how their farming and ranching operations may have an effect on certain aspects of the environment;

*Educate area farmers and ranchers on correct methods of fertilization, pesticide use and irrigation so as to reduce adverse environmental impacts;

*Promote a good working relationship between the local agricultural community and state and federal agencies involved in RCWP.

The CES I&E activities were major undertakings which achieved much success. (See Chapter 4-I&E).

Economic Evaluation Goals and Objectives

Economic evaluation goals and objectives for the RCWP were never clearly defined or implemented for the project. The original RCWP application stated that the Economic Statistics and Cooperative Service (ESCS)

would be responsible for coordinating the review of local acceptance and economic evaluation of the project.

Goals were established for the Economic Research Service (ERS) to:

*Participate on the LCC as requested;
*Make data available from existing and planned ERS surveys relating to water quality and other matters;

*Assist in project evaluation as appropriate;

The early 1980s brought tough economic times to the area. The Valentine-O'Neill Production Credit Association (PCA) closed its doors and ceased operations. Many producers in the watershed area were temporarily without a credit source. The LCC wanted to make the cost-share economically feasible in order to begin RCWP practices. It was hoped that once practices began, they would create economic benefits for the future. The LCC made a commitment to find funding sources for producers to try to assure that credit would be available for water quality practices. The FmHA expressed a desire to provide credit assistance to their customers whenever commericial credit would not be available.

The ERS was never involved in the project. It was not understood how to incorporate an economic assessment or evaluation. The economic goals and objectives were not addressed.

Water Quality Monitoring Goals and Objectives

The importance of water quality monitoring in any project cannot be overstated. Data from monitoring is the best measure by which water quality changes within an area can be evaluated. Without sufficient pre- and post-monitoring data, a project's effectiveness or the effectiveness of individual BMPs cannot be determined. The RCWP project was an experimental NPS pollution control project. It was therefore of high importance that a significant amount of pre- and post-monitoring data collection be carried out. This information is not only vital for determining the overall effectiveness of the project but necessary for the planning and development of future water quality projects addressing NPS pollution.

The Long Pine RCWP submitted an application for Comprehensive Water Quality Monitoring Funds in 1981. The funding would have provided for intensive daily monitoring of ground and surface waters. The watershed, however, was not selected for this extensive monitoring program. Monitoring therefore had to fit into the economic framework of the project.

In 1981 The Nebraska Department of Environmental Control (NDEC) agreed to monitor ground and surface waters throughout the life of the project, not to exceed 15 years. RCWP funds were not allocated for performing this general monitoring. Funding sources for monitoring were made through NDEC and other state and local agencies. Assistance in data collection was to be received from the NGPC and MNNRD with USDA Agricultural Research Service providing support on a consulting basis. At the beginning of the project, the local SCS did all of the data collection (with some help from the NGPC) for the NDEC baseline study.

The water quality monitoring program was designed to be implemented in three phases. These were:

1. Monitoring before BMP implementation;
2. Monitoring during BMP implementation;
3. Monitoring after BMP implementation.

Phase 1 (Pre-Implementation): The Long Pine RCWP was extremely fortunate that an intensive water quality monitoring study had already begun in 1979. This study, prepared by the Nebraska Department of Environmental Control, addressed the physical, chemical and biological health of waters throughout the watershed area.

The objectives of the monitoring program were to:

*document existing surface and ground water conditions in order to assist the pre-implementation phase of the RCWP project;

*identify problem areas for prioritization and to give guidance in the placement of specific BMPs for effective NPS pollution control;

*determine any land use impairments of water quality beneficial use;

*provide data that could be used to relate specific BMPs to any improved beneficial uses of water;

This monitoring project was conducted from 1979 through 1985. The final report by the NDEC "Water Quality in the Long Pine Rural Clean Water Project, 1979-1985" provided the important baseline data for the RCWP project.

Phase 2 (During Implementation): The Phase 2 objectives were basically to continue the collection of data, but on a much smaller scale than in Phase 1, with the same objectives in mind.

Phase 3 (Post-Implementation): Objectives of Phase 3 are to perform an intensive post-monitoring collection of data with which to evaluate the effectiveness of BMPs and to evaluate the general outcome of the watershed project. Phase 3, to be done by the NDEC, is scheduled to begin in 1992 and extend through 1995.

Water Quality Monitoring goals and objectives were unchanged throughout the project. However, Phase 3, post-monitoring, is currently being planned as a more extensive project. When it appeared that the Long Pine RCWP project would not be utilizing the total cost-share funds allocated for the project, the NDEC, with the approval of LCC, planned a more intensive post monitoring program. Unallocated cost-share funds are scheduled to be transferred to the NDEC for this intensive post-monitoring study sometime in 1992 when monitoring is scheduled to begin. (See Chapter 6-Water Quality Monitoring).

Project Development

Highlights of Project Development:

Due to economic factors and confusion over priority areas, the Long Pine RCWP got off to a slow start. Contracting was extremely difficult due to a depressed economy. Many area producers were involved in bankruptcies. Although there was interest in the project, it was becoming difficult for some area producers to commit themselves to the 25% of implementation expenses they would be required to provide.

Progress continued at a modest rate. Although the area was selected for the RCWP project in 1981, in 1982 the total BMP expenditures were only $9,459, and in 1983 $3,771. BMP implementation finally got underway in 1984 and 1985, but contracting was still not completed. Contracting continued through 1986 so that goals could be met.

The 1985 farm bill (which allocated farm subsidy payments) alleviated economic stress felt throughout the area. Producers were able to think about installing conservation practices. Originally, it was felt that the greatest BMP activity would be the early years of the project. In this case, the opposite was true as the peak years of implementation took place from 1985 to 1991.

Throughout the contracting period and BMP implementation process, several SCS planners worked on the RCWP. Each planner brought new ideas to the experimental RCWP project. Project development was reflected through each individual's concept and approach to the RCWP. The LCC members felt that this inconsistent approach to problems broke up the continuity of project development and implementation.

As the project developed, the Long Pine RCWP was successful in involving many agencies. The MNNRD, the North Central Resource Conservation and Development Association (NCRC&D), the Natural Resource Commission (NRC), the NDEC (Headwaters 319 project), the Ainsworth Irrigation District (AID), and the NGPC made significant contributions throughout the 10 years of development and implementation.

This interagency working relationship was vital to the success of the project. Without their involvement and commitment to the project RCWP success would have been limited. (See Chapter 5-Institutional Relationships and Economics).

Summary of Annual Achievements:

The summary of annual achievements will be addressed as follows:

*A brief annual summary of achievements in Program Development, Noncost-share Practices Initiated, and I&E Accomplishments; followed by,

*A chart which addresses cost-share achievements for the corresponding year.

1982 Achievements:

Program Development:

*In 1982 the LCC was organized and contracting was underway;

*Seven RCWP contracts were written;

*MNNRD contracted with NRC for topographic and engineering on Willow Creek; contour maps were delivered;

*MNNRD sponsored a grade stabilization structure on West Sand Draw;

*RC&D begins design for roadside erosion control;

*SCS tests a new synthetic matting material to be incorporated into waterway systems;

*NDEC continues intensive monitoring study;

Noncost-Share Practices Initiated:

*481.8 acres BMP 1-510 Pasture and Hayland Mgt.
*1,978 acres BMP 1 528-Proper Grazing Use
*15 acres BMP 1 645-Wildlife Upland Habitat Mgt.
*2 acres BMP 10-Channel Vegetation
*700 acres BMP 9-328 Conservation Cropping System
*639 acres BMP 10-329 Conservation Tillage System
*700 acres BMP 9-344 Crop Residue Use
*714.8 acres BMP 13-449 Ir. Water Management

I&E Achievements:

*LPRCWP newsletter was begun
*Integrated Pest Management (IPM) begins
*Weigh Wagon Tests and fertilizer program initiated
*Irrigation training sessions offered by CES
*Conservation tillage meetings offered by CES

A chart detailing BMP Cost-share achievements for 1982 follows:

ANNUAL ACHIEVEMENTS 1982 TOTAL COST-SHARE $9,459

BMP	PRACTICE CODE/DESCRIPTION	ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
1	550 Range Seeding	65	65 acres		$ 1,823
13	430 Pipeline	125	1,515.5 ft.		3,433
13	447 Ir Sys Tailwater Recovery	125	1 sys.	1,335 cu yds	3,823
14	612 Tree Planting	3	3 acres	1,000 trees	380

1983 Achievements:

Program Development:

*Contracts were written on 18 farms

*streambank protection study conducted on Willow Creek

*An SCS resource conservation and development plan was signed in cooperation with Brown County Commissioners, MNNRD and the City of Long Pine for a roadside critical area project

*Design survey for feasibility of a temporary irrigation storage structure was completed

*experimental grass seeding on headwaters of Long Pine Creek utilizing Reed canary grass on eroding areas of streambank was completed

*surveys and designs completed for two feedlots

*Girl Scouts and Cub Scouts earned resource conservation awards sodding Reed Canarygrass along Long Pine Creek and planting cedar trees on severely eroded sites

*NDEC and NGPC monitor fish populations for baseline report

*Preliminary engineering work done on Sand Draw Dam by NRD

Noncost-share Practices Initiated:

*638 acres BMP 1-510 Pasture & Hayland Mgt.
*11,313 acres BMP 1-528 Proper Grazing Use
*424 acres BMP 1-644 Wildlife Wetland Habitat Mgt.
*582 acres BMP 1-645 Wildlife Upland Habitat Mgt.
*290 acres BMP 1-Planned Grazing System
*2,623 acres BMP 9-Conservation Cropping System
*372 acres BMP 8-328 Conservation Cropping System
*2,968 acres BMP 9-329 Conservation Tillage System
*2,966 acres BMP 9-344 Crop Residue Use
*1,726 acres BMP 13-449 Ir. Water Management

I&E Achievements:

*IPM attracts producers in and out of the critical area
*Herbicide Tillage study conducted
*Insect Light Trap acquired for use in determining peak egg laying for corn borer, western bean cutworm, army worm and stalk borer
*Scouting Tour
*Conservation Tillage Tour

A chart detailing BMP Cost-share achievements for 1983 follows:

ANNUAL ACHIEVEMENTS 1983 TOTAL COST-SHARE $3,771

BMP	PRACTICE CODE/DESCRIPTION	ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
1	550 Range Seeding	65	65 acres		$ 1,734
6	614 Tanks	30	1 tank		263
6	642 Wells	30	1 well		1,047
11	382 Fencing	1.5	808.5 ft.		281
15	384 Fertilizer Management	223	223 acres		223
16	514 Pesticide Management	223	223 acres		223

1984 Achievements

Project Development:

*Contracts written on 12 more farms within the critical area

*AID secondary Storage Reservoir planned

*Cedar Revetments developed for streambank stabilization

*Trial planting of willow plugs at the head-waters; NGPC donated 1,000 willow plugs

*Experimental set of wing dikes to narrow upper Long Pine Creek were installed

*MNNRD assists NDEC with ground water sampling

Noncost-share Practices Initiated:

*99 acres BMP 1-510 Pasture & Hayland Mgt.
*4,894 acres BMP 1-Proper Grazing Use
*356 acres BMP 1-644 Wildlife Habitat Mgt.
*364 acres BMP 1-645 Wildlife Upland Habitat Mgt.
*495 acres BMP 1-556 Planned Grazing System
*300 acres BMP 9-328 Conservation Cropping Sys.
*437 acres BMP 8-328 Conservation Cropping Sys.
*823 acres BMP 9-329 Conservation Tillage Sys.
*972 acres BMP 9-344 Crop Residue Use
*954 acres BMP 13-Ir. Water Management

I&E Achievements:

*Conservation Tillage on 4,538 acres within the watershed (outside the critical area)

*Pesticide Management on 4,158 acres within the watershed (outside the critical area)

*Irrigation water management initiated on 4,502 acres within the watershed (outside the critical area)

*Soybean Field Tour

*Irrigation Seminar held

*Demonstration farm planned
*Weigh Wagon use doubles

*RCWP Logo signs developed to identify RCWP participants placed on farms

A chart detailing BMP Cost-share achievements for 1984 follows:

ANNUAL ACHIEVEMENTS 1984 TOTAL COST-SHARE 81,386

BMP	PRACTICE CODE/DESCRIPTION		ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
1	55Ø	Range Seeding	34	34 acres		$ 1,Ø18
1	556	Planned Grazing System	1.153	1,153 acres		1,153
5	362	Diversion	7Ø	2,42Ø ft.	3,515.5 cu yds	6,Ø78
6	382	Fencing	91Ø	14,845.6 ft		3,829
6	614	Tanks	3,575	8 tanks		2,288
6	642	Wells	3,575	9 wells		24,Ø79
6	516	Pipeline	25	45Ø ft.		512
7	342	Critical Area Planting	5	5 acres		375
7	412	Grassed Waterway or Outlet	85	5 acres		3,318
1Ø	382	Fencing	2	3,377 ft		1,157
1Ø	58Ø	Streambank Protection	23	5,742 ft		14,536
11	342	Critical Area Planting	1	1 acre		188
12	638	Water and Sediment Control Basin	1	1 basin	5,2ØØ cu yds	9,698
13	43Ø	Pipeline	162	1,936 ft.		4,896
13	447	Ir Sys Tailwater Recovery	114	1 sys	1,559 cu yds	4,172
13	449	Irrigation Water Management	276	24 tensiometers		528
14	382	Fencing	1	518.1 ft		18.5Ø
14	612	Tree Planting	6	6 acres	1,25Ø trees	361.5Ø
15	384	Fertilizer Management	1,395	1,395 acres		1,395
16	514	Pesticide Management	1,786	1,786 acres		1,786

1985 Achievements

Project Development:

*27 Contracts were written on land in the Critical area

*Land Purchased for AID for Secondary Storage Reservoir

*MNNRD and CES sample irrigation and domestic wells within a 10 mile radius of Ainsworth

*NRC provides funding to the MNNRD topographic mapping of the project critical area

*NDEC monitoring activities are completed for baseline study, report written

*Reed Canarygrass seed, provided by CES, was planted behind cedar revetments and along eroding streambanks

*Experimental planting of 3,000 willow plugs along Long Pine Creek was done

*Roadside CATS completed along Willow Creek and in Long Pine Hills

*Gully and roadside erosion along Highway 20 crossing of Willow Creek was treated by the Nebraska Highway Dept.

*NG&P provided 25% of the cost of fencing materials for producers to fence out riparian wildlife habitats

Noncost-share Practices Initiated:

*713 acres BMP 1-510 Pasture & Hayland Mgt.
*3,639 acres BMP 1-528 Proper Grazing Use
*49 acres BMP 1-645 Wildlife Upland Habitat Mgt.
*1,232 acres BMP 1-556 Planned Grazing System
*3,579 acres BMP 9-328 Conservation Cropping Sys.
*4,001 acres BMP 9-329 Conservation Tillage Sys.
*2,911 acres BMP 9-344 Crop Residue Use
*3,814 acres BMP 13-449 Ir. Water Management

I&E Achievements:

*Fertilizer management on 4,500 acres within the watershed (outside the critical area)

*Pesticide Management on 8,400 acres within the watershed (outside the critical area)

*Insect Scouting Workshop held

*Insect Scouting Tour

***Demonstration Farm tour**

A chart detailing BMP cost-share Achievements for 1985 follows:

ANNUAL ACHIEVEMENTS 1985 TOTAL COST-SHARE $131,454

BMP	PRACTICE CODE/DESCRIPTION		ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
1	512	Pasture & Hayland Management	38	38 acres		$ 1,334
5	362	Diversion	247	6,113 ft	6,674 cu yds	14,162
6	382	Fencing	225	2,691 ft		1,046
6	614	Tanks	824	2 tanks		585
6	642	Wells	3,353	4 wells		11,344
7	342	Critical Area Planting	2	2 acres		91
7	412	Grassed Waterway or Outlet	26	1 acre		945
9	329	Conservation Tillage System	190	190 acres		1,900
10	322	Channel Vegetation	5	5 acres		359
10	382	Fencing	118	5,310 ft		2,217
10	580	Streambank Protection	11	5,474 ft		11,330
11	342	Critical Area Planting	13	13 acres		1,071
11	382	Fencing	1	643.5 ft		159
12	382	Fencing	1	1,006.5 ft		416
12	410	Grade Stabilization Structure	40	1 unit	14,269 cuyds	20,074
12	638	Water & Sediment Control Basin	1	28 basins	6,000 cuyds	1,241
13	430	Pipeline	76	10,886 ft		3,234
13	449	Irrigation Water Management	106	106 acres	1,050 cuyds	5,006
13	447	Ir Sys Tailwater Recovery	387	6 units		49,785
		Powerlines			5,202 ft	(11,492)
		Pumps			4 pumps	(8,491)
		Structures			10,535 cuyds	(29,802)
13	587	Structure for Water Control	106	12 units		3,870
14	612	Tree Planting	2	2 acres	400 trees	183
15	384	Fertilizer Management	579	579 acres		579
16	614	Pesticide Management	523	523 acres		523

1986 Achievements:

Project Development:

*contracts were written on 20 farms in the critical area

*NRC contributes to the AID secondary storage reservoir through MNNRD

*NRD provides technical assistance for AID Storage structure

*MNNRD continues to assist in ground water sampling for NDEC

*NDEC summary of ground water information from irrigation and domestic wells completed

*tillage meeting

*dry edible bean production meeting
*Deadline July 8 for writing RCWP contracts

*Completion of McCullough Hill roadside CAT

*Experimental planting of 15 aspen trees

Noncost-share Practices Initiated:

*668 acres BMP 1-510 Pasture & Hayland Mgt.
*3,166 acres BMP 1-528 Proper Grazing Use
*38 acres BMP 1-645 Wildlife Upland Habitat Mgt.
*1,914 acres BMP 9-328 Conservation Cropping Sys.
*605 acres BMP 8-328 Conservation Cropping Sys.
*2,231 acres BMP 9-329 Conservation Tillage Sys.
*1,799 acres BMP 9-344 Crop Residue Use
*720 acres BMP 9-344 Crop Residue Use
*3,339 acres BMP 13-449 Irr. Water Management

I&E Achievements:

*Demonstration farm CES: chemigation applicator training; irrigation short course

*Fertilizer Management on 4,500 acres within the watershed (outside the critical area)

*Pesticide Management on 8,178 acres within the watershed (outside the critical area)

*Pesticide applicator training; conservation tillage meeting

A chart detailing BMP cost-share achievements for 1986 follows:

ANNUAL ACHIEVEMENTS 1986 TOTAL COST-SHARE $122,073

BMP	PRACTICE CODE/DESCRIPTION		ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
1	382	Fencing	145	1,353 ft		$ 1,108
1	556	Planned Grazing System	632	632 acres		632
5	362	Diversion	190	4,755 ft	4,444 cuyds	12,084
6	382	Fencing	1,870	13,971 ft		5,971
6	516	Pipeline	391	1,767 ft		2,115
6	614	Tanks	637	2 tanks		863
6	642	Wells	314	1 well		3,823
10	580	Streambank Protection	10	3,891 ft		11,833
11	342	Critical Area Planting	14	16 acres		3,920
11	382	Fencing	133	7,646 ft		2,789
11	484	Mulching	6	3 acres		414
12	350	Sediment Basin	196	1 unit	3,132 cuyds	2,880
12	342	Critical Area Planting	2	2 acres		44
12	638	Water & Sediment Control Basin	94	13 units	1,218 cuyds	1,848
13	430	Pipeline	412	9,771 ft		33,365
		Pipeline			5,821 ft	(6,525)
		Gated Pipe			3,950 ft	(26,840)
13	447	Ir Sys Tailwater Recovery	540	5 units		18,286
		Powerline			4,037 ft	(4,709)
		Pumps			2 pumps	(4,341)
		Structures			7,515 cuyds	(9,236)
14	382	Fencing	25	16,681 ft.		5,625
14	612	Tree Planting	38	28 acres	10,189 trees	6,045
		Tree Planting			(5,221 trees)	(4,261)
		Replants			(4,968 trees)	(1,784)
15	384	Fertilizer Management	4,006	4,006 acres		4,006
16	514	Pesticide Management	4,422	4,422 acres		4,422

1987 Achievements:
(no new noncost-share practices were initiated as the contracting period ended in 1986)

Project Development:

*Ainsworth Irrigation Distrioct (AID) Storage Structure completed

*Reuse pits constructed by persons within the watershed but outside of the critical area

*Seven irrigation and 20 domestic wells were sampled by MNNRD and CES; they were analyzed by NDEC, results indicated one domestic and one irrigation well exceeded standards

*MNNRD donates and plants several thousand trees at AID Reservoir Site

I&E Achievements:

*Chemigation applicator training offered
*Irrigation short course offered
*Demonstration farm tour held
*pesticide training offered

A chart detailing BMP cost-share achievements for 1987 follows:

ANNUAL ACHIEVEMENTS 1987 TOTAL COST-SHARE $274,599

BMP	PRACTICE CODE/DESCRIPTION		ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
1	512	Pasture & Hayland Planting	13	13 acres		$ 373
1	550	Range Seeding	224	224 acres		6,416
1	556	Planned Grazing System	225	225 acres		225
5	362	Diversion	85	1,484 ft	5,778 cuyds	3,425
6	382	Fencing	210	1,633 ft		841
6	614	Tanks	573	2 tanks		562
6	642	Wells	573	2 wells		7,553
7	342	Critical Area Planting	1	1 acr		59
7	412	Grassed Waterway or Outlet	1	1 acre		405
9	329	Conservation Tillage System	116	116 acres		1,160
10	382	Fencing	46	1,405 ft		338
10	580	Streambank Protection	2	904 ft		946
		wingdikes		(400 ft)		(175)
		cedar revetments		(504 ft)		(771)
11	342	Critical Area Planting	86	7 acres		283
11	484	Mulching	1	1 acre		213
12	410	Grade Stabilization Structure	158	2 acres	5,842 cuyds	12,450
13	430	Pipeline	553	8,517 ft.		13,454
13	447	Ir Sys Tailwater Recovery	449	4 units		26.892
		Powerlines			2,425 ft	(4,430)
		Pumps			2 pumps	(7,549)
		Structures			4,140 cuyds	(14,913)
13	587	Structure for Water Control	101	2 units		290
13	587	Structure for Water Control (Pooling Agreement/Ainsworth Ir. District)		6,250 acres		186,994
14	382	Fencing	17	1,567 ft		408
14	612	Tree Planting (all replants	5	2 acres	2,300 trees	628
15	384	Fertilizer Management	5,466	5,466 acres		5,466
16	514	Pesticide Management	5,218	5,218 acres		5,218

1988 Achievements:
(no new noncost-share practices were initiated because the contracting period ended in 1986)

Project Development:

*NFS and NCRC&D schedule Timber Management Workshop

*MNNRD begins two-year ground and surface water sampling program

*Reed Canarygrass seed provided by CES planted behind cedar revetments and along eroding streambanks

*MNNRD hires engineering for structure planned at the headwaters

I&E Achievements:

*Fertilizer Management on 6,000 acres within the watershed (outside the critical area)

*Nebraska Irrigation Short Course offered

*Demonstration Farm Continues

A chart detailing BMP cost-share achievements for 1988 follows:

ANNUAL ACHIEVEMENTS 1988 TOTAL COST-SHARE $61,837

BMP	PRACTICE CODE/DESCRIPTION		ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
1	382	Fencing	47	1,436 ft		$ 404
1	550	Range Seeding	190	190 acres		8,873
2	312	Waste Management System	8	1 acre		5,955
2	362	Diversion	8	1,964 ft	1,485 cuyds	2,598
2	425	Pond	9	3 ponds	6,622 cuyds	5,861
6	382	Fencing	11	5,049 ft		1,673
6	614	Tanks	191	4 tanks		840
6	642	Wells	191	4 wells		4,826
10	322	Channel Vegetation	1	1 acre		161
11	342	Critical Area Planting	1	1 acre		126
12	350	Sediment Basin	1	1 unit	367 cuyds	3,262
13	430	Pipeline	81	1,914 ft		8,852
13	447	Ir Sys Tailwater Recovery	81		2 pumps	6,692
13	587	Structure for Water Control	27	2 units		917
14	382	Fencing	3.4	3,887 ft.		1,476
14	441	Drip System	1	1 unit		803
14	612	Tree Planting	2.2	2.2 acres	1,124 trees	513
15	384	Fertilizer Management	4,130	4,130 acres		4,130
16	514	Pesticide Management	3,875	3,875 acres		3,875

1989 Achievements:
(no noncost-share practices were initiated because the contracting ended in 1986);

Project Development:

*RCWP tour by State Committee

*480 acres of highly erodible cropland have been seeded to permanent vegetation - saving 10,000 tons of sediment entering Long Pine Creek

*5,000 feet of streambank was seeded and sodded to Reed Canary grass by SCS and CES

*MNNRD and NDEC develop water quality study to assess feedlot waste loading to Bone Creek, federal clean water act grant funds obtained for the project

*MNNRD begins sampling for Bone Creek water quality study, samples being analyzed by Chadron State College

I&E Achievements:

*Fertilizer and Pesticide Management practices widely accepted throughout watershed initiated without cost-share continuing

*demonstration farm continues

A chart detailing BMP cost-share achievements for 1989 follows:

ANNUAL ACHIEVEMENTS 1989 TOTAL COST-SHARE $64,912

BMP	PRACTICE CODE/DESCRIPTION		ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
1	313	Waste Storage Structure	1	1 acre		$ 4,496
1	512	Pasture & Hayland Planting	32	32 acres		1,236
2	342	Critical Area Planting	.5	.5 acres		172
2	382	Fencing	1	693 ft		368
2	425	Waste Storage Pond	1	1 pond	1,070 cuyds	5,946
5	362	Diversion	38	1,324 ft	5,662 cuyds	5,212
6	382	Fencing	77	870 ft		440
6	516	Pipeline	115	2,180 ft		1,799
6	614	Tanks	500	2 tanks		682
6	642	Wells	385	1 well		5,416
7	412	Grassed Waterway or Outlet	37	908 ft		3,772
10	580	Streambank Protection	5	1,435		2,739
		wingdikes		(450)		(848)
		cedar revetments		(985)		(1,891)
11	342	Critical Area Planting	2	2 acres		100
11	484	Mulching	1	1 acre		147
12	587	Structure for Water Control	125	4 units	245 cuyds	2,128
13	430	Pipeline	243	5,488 ft		14,643
13	447	Ir Sys Tailwater Recovery	148			10,588
		Powerline			470 ft	(2,004)
		Pump			2 pumps	(8,584)
14	382	Fencing	6	4,271 ft		1,209
14	612	Tree Planting	3.7	3.7 acres	1,484 trees	1,184
15	384	Fertilizer Management	1,574	1,574 acres		1,574
16	514	Pesticide Management	1,061	1,061 acres		1,061

1990 Achievements:
(no new noncost-share practices were initiated because contracting ended in 1986);

Project Development:

*Most practices are completed

*NGPC Wildlife Habitat Program offered free tree seedlings for wildlife habitat

*MNNRD completes sampling for Bone Creek Study

*MNNRD applies through NDEC for federal Clean Water ACT Section 319 funding for a project on the headwaters of Long Pine Creek, project to address headcutting

*Section 319 funding approved for the headwaters project

I&E Achievements:

*Pesticide Applicator training meetings

*demonstration farm continues

*IPM continues

A chart detailing BMP cost-share achievements for 1990 follows:

ANNUAL ACHIEVEMENTS 1990 TOTAL COST-SHARE $52,501

BMP	PRACTICE CODE/DESCRIPTION		ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
5	362	Diversion	46	1,953 ft	1,411 cuyds	$ 2,809
5	620	Underground Outlet	79	620 ft		2,186
6	378	Pond	1	1 pond	2,718 cuyds	2,873
6	516	Pipeline	293	4,610 ft		4,426
6	614	Tanks	651	7 tanks		1,681
6	642	Wells	551	3 wells		5,181
12	638	Water & Sediment Control Basin	2	2 units	373 cuyds	5,058
13	430	Pipeline	300	3,288 ft		6,287
		Pipeline		(2,376 ft)		(3,827)
		Gated pipe		(912 ft)		(2,460)
13	447	Ir Sys Tailwater Recovery	1	1 unit		18,041
		Powerline			1,490 ft	(5,937)
		Pumps			3 pumps	(8,363)
		Structure			1,575 cuyds	(3,741)
13	587	Structure for Water Control	134	1 unit	.8 cuyds	227
14	382	Fencing	12.8	2,799 ft		863
14	612	Tree Planting	4.6	4.6 acres	1,192 trees	495
		Tree Planting			(1,009 trees)	(426)
		Replants			(183 trees)	(69)
15	384	Fertilizer Management	1,144	1,144 acres		1,144
16	514	Pesticide Management	1,230	1,230 acres		1,230

1991 Achievements:
(no new noncost-share practices were initiated because contracting ended in 1986);

Project Developments:

*Drop structure installed on the headwaters of Long Pine Creek as part of the Section 319 project

*Bone Creek water quality data forwarded to the NDEC for assessment

*Most practices have been completed

I&E Achievements:

*Fertilizer and Pesticide training and application continues on thousands of acres throughout the watershed

*Demonstration farm continues

Cost-share achievements for 1991 (through April 1991) follow:

ANNUAL ACHIEVEMENTS 1991 TOTAL COST-SHARE $55,548

BMP	PRACTICE CODE/DESCRIPTION		ACRES SERVED	UNITS APPLIED	MISC. UNITS REPORTED	TOTAL C/S
1	550	Range Seeding	20	20 acres		$ 356
2	425	Waste Storage Pond	1	1 pond		1,786
6	382	Fencing	246	2,955 ft		956
11	342	Critical Area Seeding	2.5	2 acres		52
12	410	Grade Stabilization Structure	144	3 units	26,253 cuyds	34,907
12	587	Structure for Water Control	1	1 unit	1,330 cuyds	1,303
13	587	Structure for Water Control	46	1 unit		1,100
13	430	Pipeline	89	1,789 ft		6,614
		Pipeline		(589 ft)		(2,409)
		Gated pipe		(1,200 ft)		(4,205)
13	447	Ir Sys Tailwater Recovery	162	2 units	2.5 cuyds	7,738
		Powerline			1,200 ft	
		Pumps			2 pumps	
14	612	Tree Planting	1	1 acre	50 trees	16
15	384	Fertilizer Management	720	720 acres		720

Changes in Land Use Patterns and Water Resource Management Throughout the Project Period

Impact and Effect of Federal Programs

Federal programs had a significant impact on land use and a minor impact on water management. The degree of crop production in the watershed is directly linked to federal farm subsidy (set-aside) programs. Under set-aside programs, the farmer idles a portion of his base land in order to receive payments.

Most of the farmers in the Long Pine Watershed area are cash crop producers. Farmers grow a crop, harvest and sell it, and generally grow the same crop the next year. Although corn is the main crop produced, there is a small amount of popcorn, soybean and alfalfa production. Alternative crops such as milo, artichokes, sunflowers, etc. have been cultivated, but with little success. The soil types, length of growing season, temperatures, and rainfall are mainly suitable for corn or alfalfa production. There is, however, no market for alfalfa. Thus the majority of area farmers are generally not involved in crop rotation programs.

Most of the farmers in the Long Pine Watershed participate in federal farm programs. The programs are adjusted annually, based on grain stocks on hand. The following is a recap of federal programs which affected land use throughout the decade of the RCWP.

In the early 1980s there was a great surplus of grain stocks in the United States. Commodity prices were low. In 1983 the USDA initiated a farm program that involved idling 50% of base land. That same year the U.S. suffered a drought throughout the grain producing regions of the nation. The combination of a 50% set-aside and drought drastically reduced grain surpluses. In 1984, farmers were entitled to produce grain on all of their acres. So the programs went from a 50% set-aside in 1983 to zero in 1984.

In 1985, farmers produced the largest corn crop ever recorded in U.S. history. Grain surpluses could not be exported to the degree needed to motivate prices. As grain prices fell, farmers adopted practices designed to produce even greater yields. In 1986, with a 20% set-aside program, the U.S. agriculture community produced the second largest corn crop ever recorded. As the agricultural economy continued to deteriorate, farm programs were designed to further reduce production while subsidizing the farmer. More base land was idled.
In 1988, a drought occured again in many feed grain producing regions. This reduced the accumulation of grain stocks significantly. However, due to a lack of world demand for grain, farm programs have continued with set-aside requirements fluctuating annually.

Throughout the entire decade of the 1980s, the amount of acres farmed in the watershed area was directly related to the annual set-aside required by farm programs. This dramatically affected the amount of acreage planted to grain, the amount of chemicals applied to land, and the amount of water needed to irrigate the cropland. These factors will need to be taken into account when evaluating water quality monitoring data for each specific year.

Other federal programs to affect land use were the Dairy Termination Program (DTP) and the Conservation Reserve Program (CRP). Although only one producer entered the DTP, many others enrolled their acres in the CRP. (See CRP and DTP participation map in Appendix).

Impact and Effect of Cropping and Chemical Use Changes

As set-aside requirements increased and commodity prices plummeted, producers in the area made significant changes in chemical use in an attempt to increase yields. Generally, this involved a greater use of nitrogen and other chemicals. Some chemical companies began '200 bushel clubs' which encouraged increased fertilizer and other chemical applications in an attempt at much greater yields. This temporary surge in chemical application only lasted a few years.

Changes in Population, Construction, and other factors

There is no major industry or development in the Long Pine Watershed area. Although there was much discussion of locating a potato processing plant at the Rock and Brown County line, this has not been achieved.

The area experienced a 15% reduction in population during the decade of the 1980s. This is due to the severely depressed agricultural economy of the early 1980s.

Impact and Effect of RCWP

During the 1980s, producers had few funds available for conservation measures. The RCWP 75% cost-share made it possible for many producers to implement BMP practices on their farms that otherwise would not have been possible.

Land Use: Land use changes occurred under BMP 6-Grazing Land Protection System. Approximately 11.4% of all cost-share funds were spent on wells, tanks and fencing. These were generally installed to keep livestock out of streams and to help stabilize streambanks, but they also provided a more efficient utilization of pastures.

The I&E portion of the RCWP educated many area farmers in the reduction of fertilizers and pesticides on their farms. The reduced chemical applications were economically efficient. Producers realized a decrease in production costs without sacrificing yields. Producers inside and outside of the critical area widely adopted these practices. As a result, fertilizer use has been greatly reduced, along with the use of pesticides.

Water Resource Management: Water resource management within the watershed changed dramatically as a result of the RCWP for two main reasons:

*As a direct result of BMPs installed specifically to address irrigation water management, and

*As a result of irrigation scheduling to coincide with BMP 15-Residual Nitrate Management

A major portion of the RCWP cost-share dollars were allocated to BMPs that involved water and irrigation management. Approximately 51.3% of all funds expended were for BMP 13-Improving an Irrigation and/or Water Management System. Another 5.4% was allocated under BMP 5-Diversion System.

Irrgation Scheduling was a major part of the Residual Nitrate Management program. Producers began scheduling irrigation to coincide with fertilizer management instead of blindly saturating fields throughout the entire growing season until the first frost. Producers outside of the critical area adopted irrigation scheduling practices as part of their Residual Nitrate Management. A few producers also invested in tailwater recovery and diversion systems on their own.

CHAPTER 3—IMPLEMENTATION RESULTS

Findings and Recommendations

Many valuable lessons were learned during the 10 years of development and application of BMPs within the Long Pine watershed. Most fall into the following categories:

1. Implementation Highlights
2. Implementation Difficulties
3. Critical Area Definition
4. Establishing Priorities
5. Documentation of Technical and Cost-Share Data
6 Assessment of nonpoint source pollution
7. Initiating innovative, experimental practices
8. Uniformity of Data Reporting
9. Technical Personnel Lessons Learned

1. Implementation Highlights: The main areas of BMP innovation and success were:

*__Ainsworth Irrigation District Secondary Storage Structure__: This reservoir was completed in 1987 at a cost of approximately $250,000. Eight producers contributed a total of $186,994 in pooling cost-share funds to the project. The reservoir diverts irrigation water from a 53 mile long canal immediately following heavy rains. Irrigation water shutdown time decreased from 24-48 hours to 6-8 hours.

*__Cedar Revetments__: Revetments were one of the most innovative and successful practices implemented under the RCWP. As of April, 1991, 19,000 feet of revetments had been constructed for streambank stabilization. They also provided a variety of habitat benefits to trout and other acquatic life.

*__Fertilizer and Pesticide Management:__ These practices, developed by CES, were widely adopted outside the critical area. Using deep soil sampling and irrigation scheduling, fertilizer use was greatly reduced throughout the watershed. An Integrated Pest Management (IPM) Association involving field scouting, resulted in a large reduction in pesticide use.

*__Tailwater Recovery:__ Over half of all cost-share funds were spent on BMP 13, Improving an Irrigation and/or Water Management System; 21.8% was for the AID secondary storage structure. The rest centered around tailwater recovery. By collecting irrigation runoff, sediment and chemicals were prevented from entering surface waters. The water collected was then reused. This recycling of runoff

saved energy and dollars in addition to reducing the amount of sediment entering streams.

***Knowledge and Experience Gained:** Working with the RCWP was an educational experience. Technicians gained a great deal of knowledge and insight into NPS pollution. This knowledge can now be applied to other water quality projects.

***BMP "systems":** Emphasis on BMP 'systems' as opposed to individual practices better address overall problems. Systems combine both cost-share and noncost-share practices.

2. Implementation Difficulties:

Implementation difficulties centered around:

*National priority given to other USDA programs during peak years of BMP implementation, specifically Highly Erodible Land (HEL) determinations and the Conservation Reserve Program (CRP) from 1985-1989 and wetland determinations in 1987. These negatively effected BMP implementation.

*Time consuming design and approval procedures for practices under BMP 2 which delayed implementation.

*Selection of locations for many practices, especially diversion systems.

*Scheduling of work. Many practices required extensive spring or fall work. If for any reason work could not begin in a timely manner, practices were delayed until the following year. Wet springs were responsible for delaying work on many practices.

*Lack of ASCS and SCS personnel devoted solely to the RCWP at the beginning of the project.

*Lack of direction and guidance from state and national levels.

*Inability to fund controls on feedlots considered point sources.

*Inability to address streambank erosion along Sand Draw and Bone Creeks. Irrigation changed the hydrologic characteristics of the area which accelerated the natural erosion of the streambanks. It is generally felt that this streambank erosion was not adequately addressed. Revetments and other stablilization practices were not readily applicable to these areas. Streambank erosion continues to be

a major problem along Sand Draw and Bone Creek.

3. **Critical Area Definition:**

The critical area to be targeted for treatment needs to be clearly defined and designated from the beginning of a project. Some basic guidelines are needed to assist in determining the critical area. As this area is likely to change as the project evolves, permanent documentation of acres and changes need to be recorded.

See 'Critical Area Treatment'-Chapter 3 for guidelines for determining the critical area and procedures for the permanent documentation of critical acres, critical acres under contract and subbasin identification.

4. **Establishing Priorities:**

Once the critical area is firmly established, clear-cut priorities need to be assigned in order for the implementation process to have direction. Priorities could be assigned by subbasin, by area or practice, based on the watershed's most immediate need.

The SCS and other agencies with technical expertise should determine priority areas. The LCC then needs to accept these priority determinations or further investigate. Without clearly defined priorities the project lacks direction. Priority areas were continuously disputed in the Long Pine Creek RCWP project.

An annual review of priorities combined with a status report on each priority project would be helpful. In this process the LCC could focus on the direction of the project and annually adjust priorities accordingly.

5. **Documentation of Technical and Cost-Share Data: (Tracking Land Treatment)**

Without adequate documentation of technical data, the tracking of land treatment cannot be achieved. Without the documentation of individual practice installation costs and cost-share, BMP cost effectiveness cannot be evaluated. Documentation procedures for this pertinent data must be established. The RCWP program emphasized interagency cooperation a the State and Federal levels with as many as 15 agencies involved in some capacity at various stages of the project. In order to provide continuity and a base of information, procedures for the documentation of technical and cost-share data need to be established.

Data Log: Whenever a cost-share payment is made, the ASCS program assistant has all cost and technical data at hand. This is the point at which a data log should be addressed. This proposed log would identify: date, RCWP Contract, Subbasin #, BMP, Practice Code, Acres Served, Units Applied, Misc. Unit, Soil Loss Savings, Water Saved, along with installation costs and cost-share. The data log would provide all of the information reflecting all of the activity of the project. It would be easily accessible and would be available for reference at any point in the project.

This procedure is designed to record data in the most efficient way. All of the data for each individual practice comes together only when a cost-share payment is made. Ideally the data should be entered into a computer. However, in the absence of a computer program assessible to ASCS, a data log must be kept. See format for data log in Appendix.

6. Assessment of Nonpoint Source Pollution:

The LCC did not have a good understanding of what nonpoint source (NPS) pollution was. Therefore, the LCC spent much time and energy focusing on point source pollution problems, especially nonagronomic sediment control structures and feedlots with over 1,000 animal units and under a schedule with the NDEC.

The two biggest disappointments the LCC had was the inability to have feedlots (considered point sources) made eligible for cost-share, and the disapproval of the one million dollar Sand Draw structure which was considered a nonagronomic sediment control structure. BMP 12-Sediment Retention, Erosion, or Water Control Structure, was applicable to "areas of farmland that required structural measures to solve a water quality hazard."

At the beginning of a project of this nature, members of the LCC and all agencies involved should attend an orientation seminar where NPS pollution is explained in detail and where a format for organization, critical area selection and prioritization are presented. This would have saved a tremendous amount of energy and expense in working on projects that did not have a chance of receiving cost-share funds through the RCWP.

7. Initiating Innovative, Experimental Practices:

The project lacked a format for designing and employing experimental practices. It is generally felt by SCS technicians and others working on the project, that support from the SCC was lacking, particularly for innovative and experimental practices that were already being implemented in other RCWP projects.

8. Uniformity of Data Reporting:

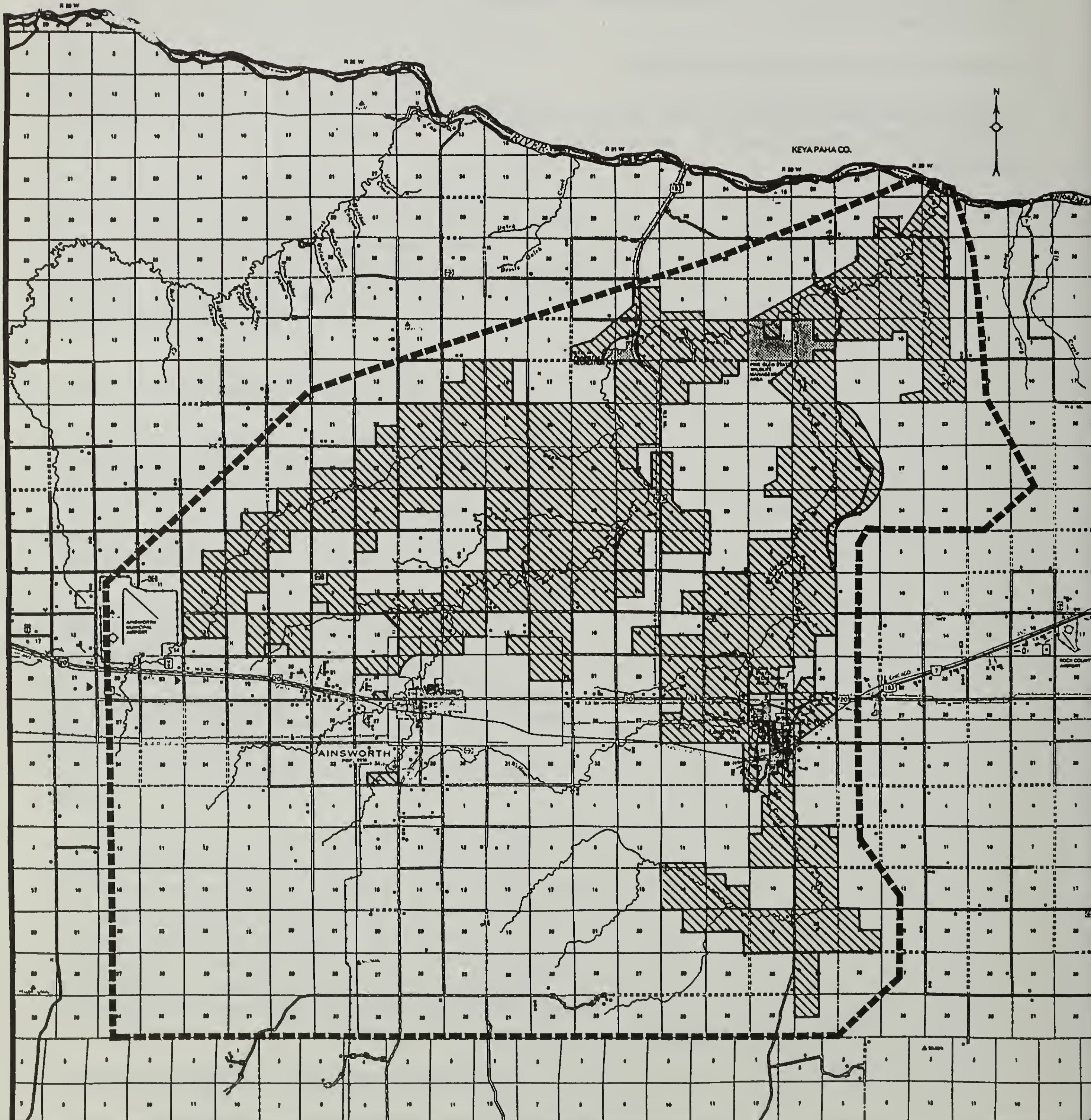
"Acres Served" and "Units Applied" data is currently being used in conjunction with water quality monitoring data to determine BMP effectiveness, land treatment accomplishments, and BMP cost effectiveness. This data is inconsistently reported.

9. Technical Personnel Lessons Learned:

Technical personnel experienced difficulties in working with the RCWP. These lessons are noted at the end of this chapter.

LONG PINE CREEK RURAL CLEAN WATER PROGRAM

Total Watershed Area:	324,988 Acres
Project Area:	196,741 Acres
Critical Area:	60,242 Acres
Acres Under Contract:	42,832 Acres
Critical Area Treated:	71 Percent



Project Area

Critical Area

Critical Area Treatment

Defining the Critical Area: At the beginning of the project, the critical area to be targeted for treatment had to be designated. Guidelines for determining the critical area were originally defined as: streambanks or gullies with active erosion, center pivot irrigated cropland with greater than 5T/ac/yr. soil loss, and rangeland in poor or fair condition. In order to determine where these areas were located, a large mosaic of the watershed was ordered from the cartography department.

This map was an invaluable visual aide in determining the critical area. Cropland fields, gullies, drainage areas, etc. were readily visible. Using the critical area guidelines, the area targeted for treatment was identified on the large aerial photo and delineated. As the project evolved, acres were added to the critical area. These acres were delineated on the large aerial photo and became the only permanent documentation of the critical area.

As many people were involved in working with various aspects of this project, critical acres, acres under contract, etc. became less clear. Uniform documentation was lacking. The tracking of BMPs implemented and critical acres was impossible. It was found that procedures were needed to:

*Establish the critical area;
*Document Critical Acres, Subbasins and acres under contract throughout the project;

The following is a procedure for the establishment of a large mosaic aerial photo of the watershed accompanied by a master file of section maps of the critical area. Documentation of critical areas, subbasins, producers and acres under contract will be made on these photos. This documentation would be easily accessible at any point in the project.

<u>**Step 1:**</u>

The Soil Conservation Service, the Department of Environmental Control, along with other agencies with technical expertise should work together to determine:

1. <u>**The subbasin lines.**</u> These are not likely to change as they are based on drainage. In the future, post monitoring may be a part of all projects. It is therefore important that the agencies that would be involved in monitoring are in agreement with other technical agencies as to where drainage lines are.

2. <u>**The Critical Area Targeted for treatment.**</u> Topography maps should be used to determine the acres contributing to surface runoff within each subbasin. These lines will be delineated on a large aerial photo of the watershed and used as a basis for determining critical acres. Critical acres will be adjusted based on variables of each project area, such as: cropland, cropping practices, erosion rates, proximity to streams and lakes, percentage of cover, etc.

   Critical Area is likely to change at some point as the project evolves. It is vital that permanent documentation of these changes be made.

Step 2:

Responsibility for documentation must be assigned. Someone must be responsible for establishing and maintaining permanent documentation of critical areas, subbasins, etc. The project coordinator or the ASCS program clerk are both likely prospects. ASCS was involved in RCWP projects as the administrative body and as head of the LCC. ASCS needs to provide a full-time person to the RCWP project for at least as long as the contracting is underway. This person should be responsible for establishing and maintaining the RCWP maps.

The ASCS RCWP Clerk or Project Coordinator will:

1. Order a mosaic of the watershed area (8" to a mile or 4" to a mile) from the Cartographic Unit.

2. Delineate on the large aerial photo the subbasin lines previously determined by SCS/NDEC etc.

3. Delineate Acres Contributing to Surface Runoff previously determined by SCS/NDEC etc.

4. Technical agencies involved will then observe the large aerial photo of the watershed and use the acres contributing to surface runoff to determine the critical area based on any contributing variables of the project area as previously noted.

5. The critical area should then be permanently delineated on the large aerial photo.

6. Pull small aerial photos (section maps) of all sections that have acres within the critical area. This will be the permanent RCWP Section Map File.

    a. Stamp on each photo the words "RCWP MAP" in the upper left hand corner of the map.

    b. Delineate the Critical area on the small photo and write in the upper left hand corner the number of acres in the critical area.

    c. Delineate (if necessary) the subbasin areas. Indicate subbasin identification in the upper left hand corner of the map or upper left hand corner of the subbasin if there is more than one.

The large aerial photo of the watershed and the small aerial photos are now the permanent record of the project. As acres are put under contract for treatment:

1. Identify on the large aerial photo the contract number/year/and name. Example: RCWP-25-1992 Bob Smith.

2. Pull the small aerial photo (section map or maps) and delineate the acres under contract with the

same notation as the large aerial photo.

If acres are added to the critical area or taken out of the critical area, the changes will first be drawn on the large aerial photo with the notation (added 1993 or deleted 1993) and then noted on the small aerial photos.

Basically, any activity within the Critical Area will be noted first on the large aerial photo and then noted on the small aerial photo. When photos are needed by any agency, a copy of the small aerial photo with current information can be made.

At the end of the project, all of the activity as far as critical acres, acres under contract, years, producers and subbasins will be documented on the maps.

NOTE: As practices are completed and noted in the data log, it would be extremely beneficial if the ASCS Program Assistant or Project Coordinator noted on the large aerial photo and then on the small aerial photos the designation of each practice at the location site. These notations would be extremely valuable as a visual aide in determining implementation progress during the project and afterwards.

Accomplishments: 'Acres Served' and 'Units Applied' data are currently being used to evaluate costs and water quality monitoring data in order to determine (1) BMP effectiveness and (2) land treatment accomplishments. 'Acres Served'and 'Units Applied' are determined by SCS technicians whenever a practice is complete. There are over 140 practices used by SCS. SCS technical standards are explicit in reporting units applied for each practice.

However guidelines for determining acres served is less explicit. Acres served is defined for ten practices and a general guideline given for others. This guideline states that acres served is "land in whole acres served, benefited, or protected by application of a conservation practice or system. Where installation benefits adjacent land, report the acres benefiting from the practice, plus the area taken up by the installation. Acres affected little or none should not be reported as acres served."

Thus, acres served was thought of in different ways by different technicians. One technician may have considered a diversion as serving the acre it was on. Another felt it served a whole field and another thought of it as serving acres both above and below the diversion site. Acres served therefore were inconsistently reported.

If acres served data is going to be used by agencies throughout the United States to make determinations of a practice's cost-effectiveness or of its effectiveness in general, then a standard method of reporting acres served for each practice needs to be established. Because this data is becoming increasingly important in determining a project's effectiveness and for use in planning and applying future BMPs, SCS should clearly define how technicians should report acres served for every practice code and in various situations.

The series of charts that follow illustrate acres served and units applied on a cumulative basis. At the top of the page the Critical Acres Under Contract for each subbasin is listed. Several practices served the same acres. For example under BMP 6, 516-pipeline, 614-tanks and 642-wells, often served many of the same acres. However, if you add all of the acres served, taking into account the acres served on the same acreage, the total is considerably less than the number of acres under contract in the subbasin, and therefore considered treated. Acres served will not reflect the number of acres treated in a contract. There are many reasons for this.

Often, the outline of the critical area was drawn around an entire quarter or 160 acres. The entire quarter was contributing to surface runoff. This quarter may have had a 125 acre pivot on it. BMP 15-Fertilizer Management and BMP 16-Pesticide management were implemented on the pivot. There was a 20% Acreage Conservation Reserve (ACR) or set-aside requirement that year. So the acres served figure, for BMP implementation, will be a figure that is less the corners around the pivot and less the ACR that was not considered treated by the practice.

Many situations similar to this occurred. There are many acres within the critical area that were actually considered treated but were not documented as treated. Therefore the extent to which the acreage under contract was treated annually is not available. We only know that when all of the practices in the contract are complete, all of the acres in the contract have been treated.

COST-SHARE PRACTICES SUBBASIN 1
CRITICAL AREA = 1,218 ACRES CRITICAL ACRES UNDER CONTRACT = 1,Ø93

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	199Ø	1991
BMP 1 382 Fencing										
Acres/Served	Ø	Ø	Ø	Ø	2	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	2	2	2	2	2	2
Units Applied-Ft.	Ø	Ø	Ø	Ø	396	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	396	396	396	396	396	396
BMP 1 55Ø Range Seeding										
Acres/Served	Ø	Ø	2	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	2	2	2	2	2	2	2	2
Units Applied-Acres	Ø	Ø	2	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	2	2	2	2	2	2	2	2
BMP 2 313 Waste Storage Struc.										
Acres/Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1
Units Applied-Struc.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1
BMP 2 425 Waste Storage Pond										
Acres/Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Units Applied-Pond	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1

Subbasin 1 continued

COST-SHARE PRACTICES SUBBASIN 1
CRITICAL AREA = 1,218 ACRES CRITICAL ACRES UNDER CONTRACT = 1,Ø93

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	199Ø	1991
BMP 5 362 Diversion										
Acres Served	Ø	Ø	5Ø	114	45	Ø	Ø	Ø	14	Ø
A/S Cumulative	Ø	Ø	5Ø	164	2Ø9	2Ø9	2Ø9	2Ø9	223	223
Units Applied-Ft.	Ø	Ø	1,5ØØ	57Ø	9ØØ	Ø	Ø	Ø	853	Ø
U/A Cumulative	Ø	Ø	1,5ØØ	2,Ø7Ø	2,97Ø	2,97Ø	2,97Ø	2,97Ø	3,823	3,823
BMP 13 43Ø Pipeline										
Acres Served	Ø	Ø	Ø	Ø	256	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	256	256	256	256	256	256
Units Applied-Ft.	Ø	Ø	Ø	Ø	4,631	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	4,631	4,631	4,631	4,631	4,631	4,631
BMP 13 447 Tailwater Recovery										
Acres Served	Ø	Ø	114	129	198	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	114	243	441	441	441	441	441	441
Units Applied-Unit	Ø	Ø	1	Ø	1	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	1	2	3	3	3	3	3	3
BMP 13 449 Ir. Water Man.										
Acres Served	Ø	Ø	276	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	276	276	276	276	276	276	276	276
Units Applied-Acres	Ø	Ø	276	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	276	276	276	276	276	276	276	276

Subbasin 1 continued

COST-SHARE PRACTICES SUBBASIN 1

CRITICAL AREA = 1,218 ACRES CRITICAL ACRES UNDER CONTRACT = 1,093

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 15 384 Fertilizer Man.										
Acres Served	0	0	0	0	565	676	660	0	0	0
A/S Cumulative										
Units Applied	0	0	0	0	565	676	660	0	0	0
U/A Cumulative										
BMP 16 514 Pesticide Man.										
Acres Served	0	0	256	0	565	676	405	0	0	0
A/S Cumulative										
Units Applied-Acres	0	0	256	0	565	676	405	0	0	0
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN 2

CRITICAL AREA = 8,601 ACRES CRITICAL ACRES UNDER CONTRACT= 5,430

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 2 342 Critical Area Planting										
Acres/Served	0	0	0	0	0	0	0	.5	0	0
A/S Cumulative	0	0	0	0	0	0	0	.5	.5	.5
Units Applied-acres	0	0	0	0	0	0	0	.5	0	
U/A Cumulative	0	0	0	0	0	0	0	.5	.5	.5
BMP 2 382 Fencing										
Acres/Served	0	0	0	0	0	0	0	1	0	0
A/S Cumulative	0	0	0	0	0	0	0	1	1	1
Units Applied-Ft.	0	0	0	0	0	0	0	693	0	0
U/A Cumulative	0	0	0	0	0	0	0	693	693	693
BMP 2 425 Waste Storage Pond										
Acres/Served	0	0	0	0	0	0	1	1	0	0
A/S Cumulative	0	0	0	0	0	0	1	2	2	2
Units Applied-Pond	0	0	0	0	0	0	1	1	0	0
U/A Cumulative	0	0	0	0	0	0	1	2	2	2
BMP 5 362 Diversion										
Acres Served	0	0	0	0	119	0	0	38	0	0
A/S Cumulative	0	0	0	0	119	119	119	157	157	157
Units Applied-Ft.	0	0	0	0	2,315	0	0	1,324	0	0
U/A Cumulative	0	0	0	0	2,315	2,315	2,315	3,639	3,639	3,639

Subbasin 2 continued

COST-SHARE PRACTICES SUBBASIN 2

CRITICAL AREA= 8,601 ACRES   CRITICAL ACRES UNDER CONTRACT= 5,430

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 7 412 Grassed Waterway or Outlet										
Acres Served	0	0	0	0	0	0	0	37	0	0
A/S Cumulative	0	0	0	0	0	0	0	37	37	37
Units Applied-Ft	0	0	0	0	0	0	0	5	0	0
U/A Cumulative	0	0	0	0	0	0	0	5	5	5
BMP 11 342 Critical Area Planting										
Acres Served	0	0	0	4.5	7	1	0	1	0	1.5
A/S Cumulative	0	0	0	4.5	11.5	12.5	12.5	13.5	13.5	15
Units Applied-Acres	0	0	0	4.5	9	1	0	2	0	1.5
U/A Cumulative	0	0	0	4.5	13.5	14.5	14.5	16.5	16.5	18
BMP 11 382 Fencing										
Acres Served	0	0	0	1	4	0	0	0	0	0
A/S Cumulative	0	0	0	1	5	5	5	5	5	5
Units Applied-Ft.	0	0	0	643.5	1,206	0	0	0	0	0
U/A Cumulative	0	0	0	643.5	1,849.5	1,849.5	1,849.5	1,849.5	1,849.5	1,849.5
BMP 11 484 Mulching										
Acres Served	0	0	0	0	3	0	0	1	0	0
A/S Cumulative	0	0	0	0	3	3	3	4	4	4
Units Applied-Acres	0	0	0	0	6	0	0	1	0	0
U/A Cumulative	0	0	0	0	6	6	6	7	7	7

Subbasin 2 continued

COST-SHARE PRACTICES SUBBASIN 2

CRITICAL AREA = 8,6Ø1 ACRES CRITICAL ACRES UNDER CONTRACT= 5,43Ø

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	199Ø	1991
BMP 12 35Ø Sediment Basin										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1	1
Units Applied-Basins	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1	1
BMP 12 41Ø Grade Stab. Struc.										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	64
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	64
Units Applied-Struc.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2
BMP 12 587 Water Control Struc.										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	93	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	93	93	93
Units Applied-Struc.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2	2	2
BMP 12 638 Water & Sed. Control Basin										
Acres Served	Ø	Ø	Ø	1	33Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	1	331	331	331	331	331	331
Units Applied -Struc.	Ø	Ø	Ø	28	11	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	28	39	39	39	39	39	39

Subbasin 2 continued

COST-SHARE PRACTICES SUBBASIN 2

CRITICAL AREA= 8,601 ACRES CRITICAL ACRES UNDER CONTRACT= 5,430

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 13 430 Pipeline										
Acres Served	0	0	147	0	0	43	81	73	0	0
A/S Cumulative	0	0	147	147	147	190	271	344	344	344
Units Applied-Ft.	0	0	1,207	0	0	1,195	1,914	1,834	0	0
U/A Cumulative	0	0	1,207	1,207	1,207	2,402	4,316	6,150	6,150	6,150
BMP 13 447 Tailwater Recovery										
Acres Served	0	0	0	28	0	99	81	0	0	73
A/S Cumulative	0	0	0	28	28	127	208	208	208	281
Units Applied-Sys	0	0	0	1	0	1	2	0	0	1
U/A Cumulative	0	0	0	1	1	2	4	4	4	5
BMP 13 587 Water Control Struc.										
Acres Served	0	0	0	0	0	0	27	0	0	0
A/S Cumulative	0	0	0	0	0	0	27	27	27	27
Units Applied-Struc.	0	0	0	0	0	0	2	0	0	0
U/A Cumulative	0	0	0	0	0	0	2	2	2	2
BMP 14 382 Fencing										
Acres Served	0	0	0	0	0	0	1.4	5	0	0
A/S Cumulative	0	0	0	0	0	0	1.4	6.4	6.4	6.4
Units Applied-Ft.	0	0	0	0	0	0	1,538	3,890.7	0	0
U/A Cumulative	0	0	0	0	0	0	1,538	5,428.7	5,428.7	5,428.7

Subbasin 2 continued

COST-SHARE PRACTICES SUBBASIN 2

CRITICAL AREA= 8,601 ACRES CRITICAL ACRES UNDER CONTRACT= 5,430

ACRES SERVED/UNITS APPLIED -- BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 14 441 Ir. Drip System										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1	1
Units Applied-Sys.	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1	1
BMP 14 612 Tree Planting										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1	2	3	3
Units Applied-Acre	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1	2	3	3
BMP 15 384 Fertilizer Man.										
Acres Served	Ø	98	147	Ø	459	1,213	754	489	443	Ø
A/S Cumulative										
Units Applied-Acres	Ø	98	147	Ø	459	1,213	754	489	443	Ø
U/A Cumulative										
BMP 16 514 Pesticide Man.										
Acres Served	Ø	98	147	Ø	459	1,213	754	298	443	Ø
A/S Cumulative										
Units Applied-Acres	Ø	98	147	Ø	459	1,213	754	298	443	Ø
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN 3

CRITICAL AREA = 305 ACRES CRITICAL ACRES UNDER CONTRACT = 250

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 2 312 Waste Man. Sys.										
Acres Served	0	0	0	0	0	0	8	0	0	0
A/S Cumulative	0	0	0	0	0	0	8	8	8	8
Units Applied-Sys.	0	0	0	0	0	0	1	0	0	0
U/A Cumulative	0	0	0	0	0	0	1	1	1	1
BMP 2 362 Diversion										
Acres Served	0	0	0	0	0	0	8	0	0	0
A/S Cumulative	0	0	0	0	0	0	8	8	8	8
Units Applied-Ft.	0	0	0	0	0	0	1,964	0	0	0
U/A Cumulative	0	0	0	0	0	0	1,964	1,964	1,964	1,964
BMP 2 425 Waste Storage Pond										
Acres Served	0	0	0	0	0	0	8	0	0	0
A/S Cumulative	0	0	0	0	0	0	8	8	8	8
Units Applied-Pond	0	0	0	0	0	0	2	0	0	0
U/A Cumulative	0	0	0	0	0	0	2	2	2	2
BMP 5 620 Underground Outlet										
Acres Served	0	0	0	0	0	0	0	0	79	0
A/S Cumulative	0	0	0	0	0	0	0	0	79	79
Units Applied-Ft.	0	0	0	0	0	0	0	0	620	0
U/A Cumulative	0	0	0	0	0	0	0	0	620	620

Subbasin 3 continued

COST-SHARE PRACTICES SUBBASIN 3
CRITICAL AREA = 3Ø5 ACRES CRITICAL ACRES UNDER CONTRACT = 25Ø

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 11 342 Critical Area Planting										
Acres Served	Ø	Ø	Ø	Ø	Ø	3	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	3	3	3	3	3
Units Applied-Acres	Ø	Ø	Ø	Ø	Ø	3	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	3	3	3	3	3
BMP 13 43Ø Pipeline										
Acres Served	Ø	Ø	Ø	Ø	54	8	Ø	79	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	54	62	62	141	141	141
Units Applied-Ft.	Ø	Ø	Ø	Ø	1,85Ø	1,531	Ø	2,42Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	1,85Ø	3,381	3,381	5,8Ø1	5,8Ø1	5,8Ø1
BMP 13 447 Tailwater Recovery										
Acres Served	Ø	Ø	Ø	Ø	54	Ø	Ø	79	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	54	54	54	133	133	133
Units Applied-Sys.	Ø	Ø	Ø	Ø	1	Ø	Ø	1	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	1	1	1	2	2	2
BMP 15 384 Fertilizer Man.										
Acres Served	Ø	Ø	Ø	Ø	235	217	215	Ø	Ø	Ø
A/S Cumulative										
Units Applied-Acres	Ø	Ø	Ø	Ø	235	217	215	Ø	Ø	Ø
U/A Cumulative										

Subbasin 3 continued

COST-SHARE PRACTICES SUBBASIN 3

CRITICAL AREA = 3Ø5 ACRES   CRITICAL ACRES UNDER CONTRACT= 25Ø

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	199Ø	1991
BMP 16 514 Pesticide Man.										
Acres Served	Ø	Ø	Ø	Ø	235	217	215	Ø	Ø	Ø
A/S Cumulative										
Units Applied-Acres	Ø	Ø	Ø	Ø	235	217	215	Ø	Ø	Ø
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN 4
CRITICAL AREA = 5,155 ACRES CRITICAL ACRES UNDER CONTRACT = 3,8Ø5

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 1 512 Pasture & Hayland Plant.										
Acres Served	Ø	Ø	Ø	Ø	Ø	2	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	2	2	2	2	2
Units Applied-Acres	Ø	Ø	Ø	Ø	Ø	2	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	2	2	2	2	2
BMP 5 362 Diversion										
Acres Served	Ø	Ø	Ø	Ø	2	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	2	2	2	2	2	2
Units Applied-Ft.	Ø	Ø	Ø	Ø	24Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	24Ø	24Ø	24Ø	24Ø	24Ø	24Ø
BMP 11 382 Fencing										
Acres Served	Ø	1.5	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Units Applied-Ft.	Ø	8Ø8.5	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	8Ø8.5	8Ø8.5	8Ø8.5	8Ø8.5	8Ø8.5	8Ø8.5	8Ø8.5	8Ø8.5	8Ø8.5
BMP 12 382 Fencing										
Acres Served	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	1	1	1	1	1	1	1
Units Applied-Ft.	Ø	Ø	Ø	1,ØØ6.5	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	1,ØØ6.5	1,ØØ6.5	1,ØØ6.5	1,ØØ6.5	1,ØØ6.5	1,ØØ6.5	1,ØØ6.5

Subbasin 4 continued

COST-SHARE PRACTICES SUBBASIN 4

CRITICAL AREA = 5,155 ACRES CRITICAL ACRES UNDER CONTRACT = 3,8Ø5

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	199Ø	1991
BMP 12 587 Water Control Struc.										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	32	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	32	32	32
Units Applied-Acres	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2	2	2
BMP 12 638 Water & Sed Control Basin										
Acres Served	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	1	1	1	1	1	1	1	1
Units Applied-Basin	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	1	1	1	1	1	1	1	1
BMP 13 43Ø Pipeline										
Acres Served	125	Ø	Ø	Ø	Ø	1Ø1	Ø	32	46	Ø
A/S Cumulative	125	125	125	125	125	226	226	258	3Ø4	3Ø4
Units Applied-Ft	1,515.5	Ø	Ø	Ø	Ø	2,381	Ø	46Ø	1,12Ø	Ø
U/A Cumulative	1,515.5	1,515.5	1,515.5	1,515.5	1,515.5	3,896.5	3,896.5	4,356.5	5,476.5	5,476.5
BMP 13 447 Tailwater Recovery										
Acres Served	125	Ø	Ø	125	Ø	42	Ø	Ø	112	Ø
A/S Cumulative	125	125	125	25Ø	25Ø	292	292	292	4Ø4	4Ø4
Units Applied-Sys.	1	Ø	Ø	1	Ø	1	Ø	Ø	2	Ø
U/A Cumulative	1	1	1	2	2	3	3	3	5	5

Subbasin 4 continued

COST-SHARE PRACTICES SUBBASIN 4

CRITICAL AREA = 5,155 ACRES CRITCAL ACRES UNDER CONTRACT = 3,8Ø5

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	199Ø	1991
BMP 13 587 Water Control Struc.										
Acres Served	Ø	Ø	Ø	Ø	Ø	1Ø1	Ø	Ø	Ø	46
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	1Ø1	1Ø1	1Ø1	1Ø1	147
Units Applied-Struc.	Ø	Ø	Ø	Ø	Ø	2	Ø	Ø	Ø	1
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	2	2	2	2	3
BMP 14 382 Fencing										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	12	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	12	12
Units Applied-Ft.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1,337	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1,337	1,337
BMP 15 384 Fertilizer Man.										
Acres Served	Ø	125	62	Ø	846	1,319	951	81	Ø	72Ø
A/S Cumulative										
Units Applied-Acres	Ø	125	62	Ø	846	1,319	951	81	Ø	72Ø
U/A Cumulative										
BMP 16 514 Pesticide Man.										
Acres Served	Ø	125	62	Ø	846	1,319	951	81	Ø	Ø
A/S Cumulative										
Units Applied-Acres	Ø	125	62	Ø	846	1,319	951	81	Ø	Ø
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN 5

CRITICAL AREA = 6,620 ACRES CRITICAL ACRES UNDER CONTRACT = 3,851

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 5 362 Diversion										
Acres Served	0	0	0	20	0	0	0	0	0	0
A/S Cumulative	0	0	0	20	20	20	20	20	20	20
Units Applied-Ft.	0	0	0	1,868	0	0	0	0	0	0
U/A Cumulative	0	0	0	1,868	1,868	1,868	1,868	1,868	1,868	1,868
BMP 6 516 Pipeline										
Acres Served	0	0	0	0	0	0	0	115	293	0
A/S Cumulative	0	0	0	0	0	0	0	115	408	408
Units Applied-Ft.	0	0	0	0	0	0	0	2,180	4,610	0
U/A Cumulative	0	0	0	0	0	0	0	2,180	6,790	6,790
BMP 6 614 Tanks										
Acres Served	0	0	0	0	0	0	0	115	293	0
A/S Cumulative	0	0	0	0	0	0	0	115	408	408
Units Applied-Tanks	0	0	0	0	0	0	0	1	3	0
U/A Cumulative	0	0	0	0	0	0	0	1	4	0
BMP 6 642 Wells										
Acres Served	0	0	0	0	0	0	0	0	293	0
A/S Cumulative	0	0	0	0	0	0	0	0	293	293
Units Applied-Wells	0	0	0	0	0	0	0	0	1	0
U/A Cumulative	0	0	0	0	0	0	0	0	1	1

Subbasin 5 continued

COST-SHARE PRACTICES SUBBASIN 5
CRITICAL AREA = 6,620 ACRES   CRITICAL ACRES UNDER CONTRACT = 3,851

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 7 342 Critical Area Planting										
Acres Served	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	1	1	1	1	1	1	1
Units Applied-Acre	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	1	1	1	1	1	1	1
BMP 11 342 Critical Area Planting										
Acres Served	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	1	1	1	1	1	1
Units Applied-Acre	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	1	1	1	1	1	1
BMP 13 43Ø Pipeline										
Acres Served	Ø	Ø	Ø	Ø	66	28Ø	Ø	59	84	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	66	346	346	4Ø5	489	489
Units Applied-Ft.	Ø	Ø	Ø	Ø	2,Ø82	1,62Ø	Ø	774	1,18Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	2,Ø82	3,7Ø2	3,7Ø2	4,476	5,656	5,656
BMP 13 447 Tailwater Recovery										
Acres Served	Ø	Ø	Ø	27	66	187	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	27	93	28Ø	28Ø	28Ø	28Ø	28Ø
Units Applied-Unit	Ø	Ø	Ø	1	1	1	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	1	2	3	3	3	3	3

Subbasin 5 continued

COST-SHARE PRACTICES SUBBASIN 5

CRITICAL AREA = 6,620 ACRES CRITICAL ACRES UNDER CONTRACT = 3,851

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 14 382 Fencing										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	1	1	.8	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1	2	2.8	2.8
Units Applied-Ft.	Ø	Ø	Ø	Ø	Ø	Ø	1,64Ø	38Ø	1,462	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1,64Ø	2,Ø2Ø	3,482	3,482
BMP 14 612 Tree Planting										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	1.2	1	2	1
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1.2	2.2	4.2	5.2
Units Applied-Acre	Ø	Ø	Ø	Ø	Ø	Ø	1.2	1	2	1
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	1.2	2.2	4.2	5.2
BMP 15 384 Fertilizer Man.										
Acres Served	Ø	Ø	Ø	Ø	448	542	542	118	175	Ø
A/S Cumulatve										
Units Applied-Acre	Ø	Ø	Ø	Ø	448	542	542	118	175	Ø
U/A Cumulative										
BMP 16 Pesticide Management										
Acres Served	Ø	Ø	118	Ø	448	542	542	Ø	175	Ø
A/S Cumulative										
Units Applied-Acre	Ø	Ø	118	Ø	448	542	542	9	175	Ø
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN ___6___
CRITICAL AREA = 7,736 ACRES CRITITICAL ACRES UNDER CONTRACT = 4,936

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 1 382 Fencing										
Acres Served	0	0	0	0	0	0	47	0	0	0
A/S Cumulative	0	0	0	0	0	0	47	47	47	47
Units Applied-Ft.	0	0	0	0	0	0	1,436	0	0	0
U/A Cumulative	0	0	0	0	0	0	1,436	1,436	1,436	1,436
BMP 1 550 Range Seeding										
Acres Served	0	0	0	0	0	190	190	0	0	0
A/S Cumulative	0	0	0	0	0	190	380	380	380	380
Units Applied-Acres	0	0	0	0	0	190	190	0	0	0
U/A Cumulative	0	0	0	0	0	190	380	380	380	380
BMP 1 556 Planned Grazing Sys.										
Acres Served	0	0	0	0	632	0	0	0	0	0
A/S Cumulative	0	0	0	0	632	632	632	632	632	632
Units Applied-Acres	0	0	0	0	632	0	0	0	0	0
U/A Cumulative	0	0	0	0	632	632	632	632	632	632
BMP 5 362 Diversion										
Acres Served	0	0	0	0	24	47	0	0	0	0
A/S Cumulative	0	0	0	0	24	71	71	71	71	71
Units Applied-Ft.	0	0	0	0	1,300	411	0	0	0	0
U/A Cumulative	0	0	0	0	1,300	1,711	1,711	1,711	1,711	1,711

Subbasin 6 continued

COST-SHARE PRACTICES SUBBASIN 6

CRITICAL AREA = 7,736 ACRES CRITICAL ACRES UNDER CONTRACT = 4,936

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 6 382 Fencing										
Acres Served	Ø	Ø	Ø	Ø	1,736	210	Ø	Ø	Ø	246
A/S Cumulative	Ø	Ø	Ø	Ø	1,736	1,946	1,946	1,946	1,946	2,192
Units Applied-Ft.	Ø	Ø	Ø	Ø	11,782	1,634	Ø	Ø	Ø	2,955
U/A Cumulative	Ø	Ø	Ø	Ø	11,782	13,416	13,416	13,416	13,416	16,371
BMP 6 516 Pipeline										
Acres Served	Ø	Ø	Ø	Ø	391	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	391	391	391	391	391	391
Units Applied-Ft.	Ø	Ø	Ø	Ø	1,767	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	1,767	1,767	1,767	1,767	1,767	1,767
BMP 6 614 Tanks										
Acres Served	Ø	Ø	Ø	599	637	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	599	1,236	1,236	1,236	1,236	1,236	1,236
Units Appied-Tanks	Ø	Ø	Ø	1	2	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	1	3	3	3	3	3	3
BMP 6 642 Wells										
Acres Served	Ø	Ø	Ø	599	314	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	599	913	913	913	913	913	913
Units Applied-Wells	Ø	Ø	Ø	1	1	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	1	2	2	2	2	2	2

Subbasin 6 continued

COST-SHARE PRACTICES SUBBASIN 6

CRITICAL AREA = 7,736 ACRES CRITICAL ACRES UNDER CONTRACT = 4,936

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 7 342 Critical Area Planting										
Acres Served	0	0	5	0	0	0	0	0	0	0
A/S Cumulative	0	0	5	5	5	5	5	5	5	5
Units Applied-Acres	0	0	5	0	0	0	0	0	0	0
U/A Cumulative	0	0	5	5	5	5	5	5	5	5
BMP 7 412 Grassed Waterway/Outlet										
Acres Served	0	0	85	0	0	0	0	0	0	0
A/S Cumulative	0	0	85	85	85	85	85	85	85	85
Units Applied-Acres	0	0	5	0	0	0	0	0	0	0
U/A Cumulative	0	0	5	5	5	5	5	5	5	5
BMP 9 329 Conservation Tillage Sys.										
Acres Served	0	0	0	190	0	0	0	0	0	0
A/S Cumulative	0	0	0	190	190	190	190	190	190	190
Units Applied-Acres	0	0	0	190	0	0	0	0	0	0
U/A Cumulative	0	0	0	190	190	190	190	190	190	190
BMP 10 322 Channel Vegetation										
Acres Served	0	0	0	5	0	0	1	0	0	0
A/S Cumulative	0	0	0	5	5	5	6	6	6	6
Units Applied-Acres	0	0	0	5	0	0	1	0	0	0
U/A Cumulative	0	0	0	5	5	5	6	6	6	6

Subbasin 6 continued

COST-SHARE PRACTICES SUBBASIN 6

CRITICAL AREA = 7,736 ACRES   CRITICAL ACRES UNDER CONTRACT = 4,936

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 1Ø 58Ø Streambank Protec. Sys.										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1
Units Applied-Ft.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	18Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	18Ø	18Ø	18Ø
BMP 11 342 Critical Area Plant.										
Acres Served	Ø	Ø	Ø	7.5	4	2	1	Ø	Ø	1
A/S Cumulative	Ø	Ø	Ø	7.5	11.5	13.5	14.5	14.5	14.5	15.5
Units Applied-Acres	Ø	Ø	Ø	7.5	4	2	1	9	9	1
U/A Cumulative	Ø	Ø	Ø	7.5	11.5	13.5	14.5	14.5	14.5	15.5
BMP 12 41Ø Grade Stab. Struc.										
Acres Served	Ø	Ø	Ø	4Ø	Ø	35	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	4Ø	4Ø	75	75	75	75	75
Units Applied-Struc.	Ø	Ø	Ø	1	Ø	1	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	1	1	2	2	2	2	2
BMP 12 587 Water Control Struc.										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Units Applied-Acres	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1

Subbasin 6 continued

COST-SHARE PRACTICES SUBBASIN 6

CRITICAL AREA = 7,736 ACRES CRITICAL ACRES UNDER CONTRACT = 4,936

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 13 430 Pipeline										
Acres Served	0	0	0	0	0	121	0	0	46	0
A/S Cumulative	0	0	0	0	0	121	121	121	167	167
Units Applied-Ft.	0	0	0	0	0	1,790	0	0	912	0
U/A Cumulative	0	0	0	0	0	1,790	1,790	1,790	2,702	2,702
BMP 13 447 Tailwater Recovery										
Acres Served	0	0	0	0	0	121	0	0	0	0
A/S Cumulative	0	0	0	0	0	121	121	121	121	121
Units Applied-Unit	0	0	0	0	0	1	0	0	0	0
U/A Cumulative	0	0	0	0	0	1	1	1	1	1
BMP 15 384 Fertilizer Man.										
Acres Served	0	0	619	0	232	21	0	0	89	0
A/S Cumulative										
Units Applied-Acres	0	0	619	0	232	21	0	0	89	0
U/A Cumulative										
BMP 16 514 Pesticide Man.										
Acres Served	0	0	427	0	232	21	0	0	89	0
A/S Cumulative										
Units Applied	0	0	427	0	232	21	0	0	89	0
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN 7

CRITICAL AREA = 3,399 ACRES CRITICAL ACRES UNDER CONTRACT = 2,559

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 5 362 Diversion										
Acres Served	Ø	Ø	20	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	20	20	20	20	20	20	20	20
Units Applied-Ft.	Ø	Ø	920	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	920	920	920	920	920	920	920	920
BMP 6 614 Tank										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	385	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	385	385	385
Units Applied-Tanks	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1
BMP 6 642 Wells										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	385	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	385	385	385
Units Applied-Wells	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1
BMP 1Ø 382 Fencing										
Acres Served	Ø	Ø	Ø	Ø	Ø	46	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	46	46	46	46	46
Units Applied-Ft.	Ø	Ø	Ø	Ø	Ø	1,4Ø5	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	1,4Ø5	1,4Ø5	1,4Ø5	1,4Ø5	1,4Ø5\

Subbasin 7 continued

COST-SHARE PRACTICES SUBBASIN 7
CRITICAL AREA = 3,399 ACRES CRITICAL ACRES UNDER CONTRACT = 2,559

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 10 580 Streambank Protec. Sys.										
Acres Served	0	0	0	0	1	0	0	0	0	0
A/S Cumulative	0	0	0	0	1	1	1	1	1	1
Units Applied-Ft.	0	0	0	0	570	0	0	0	0	0
U/A Cumulative	0	0	0	0	570	570	570	570	570	570
BMP 13 447 Tailwater Recovery										
Acres Served	0	0	0	0	0	0	0	0	1	0
A/S Cumulative	0	0	0	0	0	0	0	0	1	1
Units Applied-Unit	0	0	0	0	0	0	0	0	1	1
U/A Cumulative	0	0	0	0	0	0	0	0	1	1
BMP 13 587 Water Control Struc.										
Acres Served	0	0	0	0	0	0	0	0	134	0
A/S Cumulative	0	0	0	0	0	0	0	0	134	134
Units Applied-Struc.	0	0	0	0	0	0	0	0	1	0
U/A Cumulative	0	0	0	0	0	0	0	0	1	1
BMP 16 514 Pesticide Management										
Acres Served	0	0	209	0	127	0	0	0	0	0
A/S Cumulative										
Units Applied-Acres	0	0	209	0	127	0	0	0	0	0
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN 8

CRITICAL AREA = 2,406 ACRES CRITICAL ACRES UNDER CONTRACT = 1,806

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 1 512 Pasture & Hayland Plant.										
Acres Served	Ø	Ø	Ø	38	Ø	11	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	38	38	49	49	49	49	49
Units Applied-Acres	Ø	Ø	Ø	38	Ø	11	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	38	38	49	49	49	49	49
BMP 6 614 Tanks										
Acres Served	Ø	Ø	246	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	246	246	246	246	246	246	246	246
Units Applied-Tanks	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	1	1	1	1	1	1	1	1
BMP 6 642 Wells										
Acres Served	Ø	Ø	246	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	246	246	246	246	246	246	246	246
Units Applied-Wells	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	1	1	1	1	1	1	1	1
BMP 9 329 Conservation Tillage										
Acres Served	Ø	Ø	Ø	Ø	Ø	116	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	116	116	116	116	116
Units Applied-Acres	Ø	Ø	Ø	Ø	Ø	116	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	116	116	116	116	116

Subbasin 8 continued

COST-SHARE PRACTICES SUBBASIN 8

CRITICAL AREA = 2,4Ø6 ACRES CRITICAL ACRES UNDER CONTRACT = 1,8Ø6

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	199Ø	1991
BMP 1Ø 382 Fencing										
Acres Served	Ø	Ø	2	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	2	2	2	2	2	2	2	2
Units Applied-Ft.	Ø	Ø	3,377	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	3,377	3,377	3,377	3,377	3,377	3,377	3,377	3,377
BMP 1Ø 58Ø Streambank Protec. Sys.										
Acres Served	Ø	Ø	Ø	7	1	2	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	7	8	1Ø	1Ø	1Ø	1Ø	1Ø
Units Applied-Ft.	Ø	Ø	Ø	4,Ø51	1,845	9Ø4	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	4,Ø51	5,896	6,8ØØ	6,8ØØ	6,8ØØ	6,8ØØ	6,8ØØ
BMP 11 342 Critical Area Planting										
Acres Served	Ø	Ø	Ø	1	2	1	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	1	3	4	4	4	4	4
Units Applied-Acres	Ø	Ø	Ø	1	2	1	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	1	3	4	4	4	4	4
BMP 11 484 Mulching										
Acres Served	Ø	Ø	Ø	Ø	Ø	7	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	7	7	7	7	7
Units Applied-Acres	Ø	Ø	Ø	Ø	Ø	7	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	7	7	7	7	7\

Subbasin 8 continued

COST-SHARE PRACTICES SUBBASIN 8
CRITICAL AREA = 2,4Ø6 ACRES CRITICAL ACRES UNDER CONTRACT = 1,8Ø6

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 12 35Ø Sediment Basin										
Acres Served	Ø	Ø	Ø	Ø	196	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	196	196	196	196	196	196
Units Applied-Basin	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	1	1	1	1	1	1
BMP 14 382 Fencing										
Acres Served	Ø	Ø	1	Ø	Ø	17	1	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	1	Ø	Ø	18	19	19	19	19
Units Applied	Ø	Ø	518	Ø	Ø	1,567.5	7Ø9.5	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	518	518	518	2,Ø85.5	2,795	2,795	2,795	2,795
BMP 14 612 Tree Planting										
Acres Served	3	Ø	6	2	1	1	Ø	Ø	Ø	Ø
A/S Cumulative	3	3	9	11	12	13	13	13	13	13
Units Applied-Acres	3	Ø	6	2	1	1	Ø	Ø	Ø	Ø
U/A Cumulative	3	3	9	11	12	13	13	13	13	13
BMP 15 384 Fertilizer Management										
Acres Served	Ø	Ø	Ø	Ø	Ø	11Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	11Ø	11Ø	11Ø	11Ø	11Ø
Units Applied-Acres	Ø	Ø	Ø	Ø	Ø	11Ø	Ø	Ø	Ø	Ø
U/A Cumulative										

Subbasin 8 continued

COST-SHARE PRACTICES SUBBASIN 8

CRITICAL AREA = 2,406 ACRES CRITICAL ACRES UNDER CONTRACT = 1,806

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 16 514 Pesticide Management										
Acres Served	0	0	0	0	0	110	0	0	0	0
A/S Cumulative										
Units Applied-Acres	0	0	0	0	0	110	0	0	0	0
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN 9

CRITICAL AREA = 5,114 ACRES   CRITICAL ACRES UNDER CONTRACT = 2,414

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 5 362 Diversion										
Acres Served	0	0	0	0	0	0	0	0	32	0
A/S Cumulative	0	0	0	0	0	0	0	0	32	32
Units Applied-Ft.	0	0	0	0	0	0	0	0	1,100	0
U/A Cumulative	0	0	0	0	0	0	0	0	1,100	1,100
BMP 6 378 Pond										
Acres Served	0	0	0	0	0	0	0	0	1	0
A/S Cumulative	0	0	0	0	0	0	0	0	1	1
Units Applied-Ponds	0	0	0	0	0	0	0	0	1	0
U/A Cumulative	0	0	0	0	0	0	0	0	1	1
BMP 6 382 Fencing										
Acres Served	0	0	372	0	0	0	0	0	0	0
A/S Cumulative	0	0	372	372	372	372	372	372	372	372
Units Applied-Ft.	0	0	1,303.5	0	0	0	0	0	0	0
U/A Cumulative	0	0	1,303.5	1,303.5	1,303.5	1,303.5	1,303.5	1,303.5	1,303.5	1,303.5
BMP 13 430 Pipeline										
Acres Served	0	0	0	76	0	0	0	0	124	0
A/S Cumulative	0	0	0	76	76	76	76	76	200	200
Units Applied-Ft.	0	0	0	1,886	0	0	0	0	76	0
U/A Cumulative	0	0	0	1,886	1,886	1,886	1,886	1,886	1,962	1,962

Subbasin 9 continued

COST-SHARE PRACTICES SUBBASIN___9____
CRITICAL AREA = 5,114 ACRES CRTITICAL ACRES UNDER CONTRACT= 2,414

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 13 447 Tailwater Recovery										
Acres Served	Ø	Ø	Ø	76	Ø	Ø	Ø	Ø	76	Ø
A/S Cumulative	Ø	Ø	Ø	76	76	76	76	76	152	152
Units Applied-Unit	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	1	Ø
U/A Cumulative	Ø	Ø	Ø	1	1	1	1	1	2	2
BMP 15 384 Fertilizer Man.										
Acres Served	Ø	Ø	117	Ø	615	549	264	432	163	Ø
A/S Cumulative										
Units Applied-Acres	Ø	Ø	117	Ø	615	549	264	432	163	Ø
U/A Cumulative										
BMP 16 514 Pesticide Man.										
Acres Served	Ø	Ø	117	Ø	615	549	264	432	163	Ø
A/S Cumulative										
Units Applied-Acres	Ø	Ø	117	Ø	615	549	264	432	163	Ø

COST-SHARE PRACTICES SUBBASIN 10

CRITICAL AREA = 5,711 ACRES CRITICAL ACRES UNDER CONTRACT = 3,211

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 1 550 Permanent Veg. Cover										
Acres Served	65	65	32	0	0	0	0	0	0	20
A/S Cumulative	65	130	162	162	162	162	162	162	162	182
Units Applied-Acres	65	65	32	0	0	0	0	0	0	0
U/A Cumulative	65	130	162	162	162	162	162	162	162	182
BMP 1 556 Planned Graz. Sys.										
Acres Served	0	0	0	0	0	225	0	0	0	0
A/S Cumulative	0	0	0	0	0	225	225	225	225	225
Units Aplied-Acres	0	0	0	0	0	225	0	0	0	0
U/A Cumulative	0	0	0	0	0	225	225	225	225	225
BMP 6 382 Fencing										
Acres Served	0	0	158	225	134	0	11	77	0	0
A/S Cumulative	0	0	158	383	517	517	528	605	605	605
Units Applied-Ft.	0	0	2,079	2,691	2,190	0	5,049	870	0	0
U/A Cumulative	0	0	2,079	4,770	6,960	6,960	12,009	12,009	12,879	12,879
BMP 6 516 Pipeline										
Acres Served	0	0	25	0	0	0	0	0	0	0
A/S Cumulative	0	0	25	25	25	25	25	25	25	25
Units Applied-Ft.	0	0	450	0	0	0	0	0	0	0
U/A Cumulative	0	0	450	450	450	450	450	450	450	450

Subbasin 10 continued

COST-SHARE PRACTICES SUBBASIN 10

CRITICAL AREA = 5,711 ACRES CRITICAL ACRES UNDER CONTRACT = 3,211

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 6 614 Tanks										
Acres Served	0	30	25	225	0	0	191	0	358	0
A/S Cumulative	0	30	55	280	280	280	471	471	829	829
Units Applied-Tanks	0	1	1	1	0	0	4	0	4	0
U/A Cumulative	0	1	2	3	3	3	7	7	11	11
BMP 6 642 Wells										
Acres Served	0	30	81	225	0	0	191	0	358	0
A/S Cumulative	0	30	111	336	336	336	527	527	885	885
Units Applied-Wells	0	1	2	1	0	0	2	0	2	0
U/A Cumulative	0	1	3	4	4	4	6	6	8	8
BMP 10 382 Fencing										
Acres Served	0	0	0	54	0	0	0	0	0	0
A/S Cumulative	0	0	0	54	54	54	54	54	54	54
Units Applied-Ft.	0	0	0	3,231	0	0	0	0	0	0
U/A Cumulative	0	0	0	3,231	3,231	3,231	3,231	3,231	3,231	3,231
BMP 10 580 Streambank Protec. Sys.										
Acres Served	0	0	2	1	7	0	0	1	0	0
A/S Cumulative	0	0	2	3	10	10	10	11	11	11]
Units Applied-Ft.	0	0	339	750	2,413.4	0	0	225	0	0
U/A Cumulative	0	0	339	1,089	3,502.4	3,502.4	3,502.4	3,727.4	3,727.4	3,727.4

Subbasin 10 continued

COST-SHARE PRACTICES SUBBASIN 1Ø

CRITICAL AREA = 5,711 ACRES CRITICAL ACRES UNDER CONTRACT = 3,211

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 11 342 Critical Area Plant.										
Acres Served	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	1	1	1	1	1	1	1	1
Units Applied-Acres	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	1	1	1	1	1	1	1	1
BMP 12 342 Critical Area Plant.										
Acres Served	Ø	Ø	Ø	Ø	2	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	2	2	2	2	2	2
Units Applied-Acres	Ø	Ø	Ø	Ø	2	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	2	2	2	2	2	2
BMP 12 41Ø Grade Stab. Struc.										
Acres Served	Ø	Ø	Ø	Ø	Ø	123	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	123	123	123	123	123
Units Applied-Struc.	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	1	1	1	1	1
BMP 12 638 Water & Sed. Basin										
Acres Served	Ø	Ø	Ø	Ø	14	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	14	14	14	14	14	14
Units Applied-Basin	Ø	Ø	Ø	Ø	2	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	2	2	2	2	2	2

Subbasin 1Ø continued

COST-SHARE PRACTICES SUBBASIN 10
CRITICAL AREA = 5,711 ACRES CRITICAL ACRES UNDER CONTRACT = 3,211

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 13 430 Pipeline										
Acres Served	0	0	0	0	106	0	0	0	0	0
A/S Cumulative	0	0	0	0	106	106	106	106	106	106
Units Applied-Ft.	0	0	0	0	1,208	0	0	0	0	0
U/A Cumulative	0	0	0	0	1,208	1,208	1,208	1,208	1,208	1,208
BMP 13 447 Tailwater Recovery										
Acres Served	0	0	0	0	106	0	0	69	0	0
A/S Cumulative	0	0	0	0	106	106	106	175	175	175
Units Applied-Unit	0	0	0	0	1	0	0	1	0	0
U/A Cumulative	0	0	0	0	1	1	1	2	2	2
BMP 13 449 Ir. Water Man.										
Acres Served	0	0	0	106	0	0	0	0	0	0
A/S Cumulative	0	0	0	106	106	106	106	106	106	106
Units Applied-Acres	0	0	0	106	0	0	0	0	0	0
U/A Cumulative	0	0	0	106	106	106	106	106	106	106
BMP 13 587 Water Control Struc.										
Acres Served	0	0	0	106	0	0	0	0	0	0
A/S Cumulative	0	0	0	106	106	106	106	106	106	106
Units Applied-Struc.	0	0	0	12	0	0	0	0	0	0
U/A Cumulative	0	0	0	12	12	12	12	12	12	12

Subbasin 10 continued

COST-SHARE PRACTICES SUBBASIN 10
CRITICAL AREA = 5,711 ACRES CRITICAL ACRES UNDER CONTRACT = 3,211

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 14 612 Tree Planting										
Acres Served	0	0	0	0	0	0	0	1.7	1.6	0
A/S Cumulative	0	0	0	0	0	0	0	1.7	3.3	3.3
Units Applied-Acres	0	0	0	0	0	0	0	1.7	1.6	0
U/A Cumulative	0	0	0	0	0	0	0	1.7	3.3	3.3
BMP 15 384 Fertilizer Man.										
Acres Served	0	0	0	96	0	89	89	0	0	0
A/S Cumulative										
Units Applied-Acres	0	0	0	96	0	89	89	0	0	0
U/A Cumulative										
BMP 16 Pesticide Man.										
Acres Served	0	0	0	0	0	89	89	0	86	0
A/S Cumulative										
Units Applied-Acres	0	0	0	0	0	89	89	0	86	0
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN___11_____
CRITICAL AREA = 6,949 ACRES CRITICAL ACRES UNDER CONTRACT = 6,629

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 1 382 Fencing										
Acres Served	Ø	Ø	Ø	Ø	143	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	143	143	143	143	143	143
Units Applied-Ft.	Ø	Ø	Ø	Ø	957	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	957	957	957	957	957	957
BMP 1 512 Pasture & Hayland Plant.										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	32	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	32	32	32
Units Applied-Acres	Ø	Ø	Ø	Ø	Ø	Ø	Ø	32	32	32
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	32	32	32
BMP 1 550 Range Seeding										
Acres Served	Ø	Ø	Ø	Ø	Ø	34	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	34	34	34	34	34
Units Applied-Acres	Ø	Ø	Ø	Ø	Ø	34	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	34	34	34	34	34
BMP 5 362 Diversion										
Acres Served	Ø	Ø	Ø	113	Ø	38	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	113	113	151	151	151	151	151
Units Applied-Ft.	Ø	Ø	Ø	3,675	Ø	1,073	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	3,675	3,675	4,748	4,748	4,748	4,748	4,748

Subbasin 11 continued

COST-SHARE PRACTICES SUBBASIN 11

CRITICAL AREA = 6,949 ACRES CRITICAL ACRES UNDER CONTRACT = 6,629

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 6 382 Fencing										
Acres Served	0	0	362	0	0	0	0	0	0	0
A/S Cumulative	0	0	362	362	362	362	362	362	362	362
Units Applied-Ft.	0	0	8,988	0	0	0	0	0	0	0
U/A Cumulative	0	0	8,988	8,988	8,988	8,988	8,988	8,988	8,988	8,988
BMP 6 614 Tanks										
Acres Served	0	0	1,906	0	0	573	0	0	0	0
A/S Cumulative	0	0	1,906	1,906	1,906	2,479	2,479	2,479	2,479	2,479
Units Applied-Tanks	0	0	0	0	0	0	0	32	32	32
U/A Cumulative	0	0	0	0	0	0	0	32	32	32
BMP 6 642 Wells										
Acres Served	0	0	1,906	1,376	0	573	0	0	0	0
A/S Cumulative	0	0	1,906	3,282	3,282	3,855	3,855	3,855	3,855	3,855
Units Applied-Wells	0	0	3	2	0	2	0	0	0	0
U/A Cumulative	0	0	3	5	5	7	7	7	7	7
BMP 7 342 Critical Area Plant.										
Acres Served	0	0	0	1	0	1	0	0	0	0
A/S Cumulative	0	0	0	1	1	2	2	2	2	2
Units Applied-Acres	0	0	0	1	0	1	0	0	0	0
U/A Cumulative	0	0	0	1	1	2	2	2	2	2

Subbasin 11 continued

COST-SHARE PRACTICES SUBBASIN 11

CRITICAL AREA = 6,949 ACRES CRITICAL ACRES UNDER CONTRACT = 6,629

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 7 412 Grassed Waterway/Outlet										
Acres Served	Ø	Ø	Ø	26	Ø	1	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	26	26	27	27	27	27	27
Units Applied-Acres	Ø	Ø	Ø	1	Ø	1	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	1	1	2	2	2	2	2
BMP 1Ø 382 Fencing										
Acres Served	Ø	Ø	Ø	64	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	64	64	64	64	64	64	64
Units Applied-Ft.	Ø	Ø	Ø	2,Ø79	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	2,Ø79	2,Ø79	2,Ø79	2,Ø79	2,Ø79	2,Ø79	2,Ø79
BMP 1Ø 58Ø Streambank Protec.										
Acres Served	Ø	Ø	21	5	1	Ø	Ø	2	Ø	Ø
A/S Cumulative	Ø	Ø	21	26	27	27	27	29	29	29
Units Applied-Ft.	Ø	Ø	5,4Ø3	1,133	1,1Ø2.8	Ø	Ø	1,Ø3Ø	Ø	Ø
U/A Cumulative	Ø	Ø	5,4Ø3	6,536	7,638.8	7,638.8	7,638.8	8,668.8	8,668.8	8,668.8
BMP 12 41Ø Grade Stab. Struc.										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	8Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	8Ø
Units Applied-Struc.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1

Subbasin 11 continued

COST-SHARE PRACTICES SUBBASIN 11

CRITICAL AREA = 6,949 ACRES CRITICAL ACRES UNDER CONTRACT = 6,629

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 12 638 Water & Sed. Control Basin										
Acres Served	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2	2
Units Applied-Basins	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	2	2
BMP 13 430 Pipeline										
Acres Served	Ø	Ø	15	Ø	Ø	Ø	Ø	Ø	Ø	89
A/S Cumulative	Ø	Ø	15	15	15	15	15	15	15	104
Units Applied-Ft.	Ø	Ø	729	Ø	Ø	Ø	Ø	Ø	Ø	1,789
U/A Cumulative	Ø	Ø	729	729	729	729	729	729	729	2,518
BMP 13 447 Tailwater Recovery										
Acres Served	Ø	Ø	Ø	22	Ø	Ø	Ø	Ø	Ø	89
A/S Cumulative	Ø	Ø	Ø	22	22	22	22	22	22	111
Units Applied-Unit	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	1
U/A Cumulative	Ø	Ø	Ø	1	1	1	1	1	1	2
BMP 14 382 Fencing										
Acres Served	Ø	Ø	Ø	Ø	25	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	25	25	25	25	25	25
Units Applied-Ft.	Ø	Ø	Ø	Ø	16,681.5	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	16,682	16,682	16,682	16,682	16,682	16,682

Subbasin 11 continued

COST-SHARE PRACTICES SUBBASIN 11

CRITICAL AREA = 6,949 ACRES CRITICAL ACRES UNDER CONTRACT = 6,629

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 14 612 Tree Planting										
Acres Served	Ø	Ø	Ø	Ø	37	4	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	Ø	Ø	37	41	41	41	41	41
Units Applied-Acres	Ø	Ø	Ø	Ø	27	1	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	Ø	Ø	27	28	28	28	28	28
BMP 15 384 Fertilizer Man.										
Acres Served	Ø	Ø	450	483	606	730	655	454	274	Ø
A/S Cumulative										
Units Applied-Acres	Ø	Ø	450	483	606	730	655	454	274	Ø
U/A Cumulative										
BMP 16 514 Pesticide Man.										
Acres Served	Ø	Ø	450	523	895	482	655	250	274	Ø
A/S Cumulative										
Units Applied-Acres	Ø	Ø	450	523	895	482	655	250	274	Ø
U/A Cumulative										

COST-SHARE PRACTICES SUBBASIN 12

CRITICAL AREA = 7,Ø28 ACRES CRITICAL ACRES UNDER CONTRACT = 6,848

ACRES SERVED/UNITS APPLIED - BY YEAR/CUMULATIVE

BMP DESCRIPTION	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
BMP 1 556 Planned Graz. Sys.										
Acres Served	Ø	Ø	1,153	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	1,153	1,153	1,153	1,153	1,153	1,153	1,153	1,153
Units Applied-Acres	Ø	Ø	1,153	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	1,153	1,153	1,153	1,153	1,153	1,153	1,153	1,153
BMP 6 382 Fencing										
Acres Served	Ø	Ø	18	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	18	18	18	18	18	18	18	18
Units Applied-Ft.	Ø	Ø	2,475	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	2,475	2,475	2,475	2,475	2,475	2,475	2,475	2,475
BMP 6 614 Tanks										
Acres Served	Ø	Ø	1,398	Ø	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	1,398	1,398	1,398	1,398	1,398	1,398	1,398	1,398
Units Applied-Tanks	Ø	Ø	3	Ø	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	3	3	3	3	3	3	3	3
BMP 6 642 Wells										
Acres Served	Ø	Ø	1,398	1,153	Ø	Ø	Ø	Ø	Ø	Ø
A/S Cumulative	Ø	Ø	1,398	2,551	2,551	2,551	2,551	2,551	2,551	2,551
Units Applied-Wells	Ø	Ø	3	1	Ø	Ø	Ø	Ø	Ø	Ø
U/A Cumulative	Ø	Ø	3	4	4	4	4	4	4	4

BMP Implementation

Best Management Practices (BMPs) are resource management practices developed by SCS technicians to reduce ground and surface water pollution. Fifteen BMPs were selected for use in the Long Pine Creek watershed area. Each BMP was comprised of several components (individual practices that could be implemented to achieve each BMP). Some components were eligible to receive cost-share and others were noncost-share management practices. Noncost-share management practices were necessary in designing a complete resource management system.

<u>BMP 1 Permanent Vegetative Cover</u>
Total Cost-Share Received for BMP 1 = $26,685
% of Total RCWP Cost-Share = 3.1%

The purpose of BMP 1 was to prevent excessive runoff of water or soil erosion contributing to water pollution by establishing permanent vegetative cover on critical areas. BMP 1 was applicable to areas outlined in each Water Quality Plan as sources of nonpoint agricultural pollution requiring treatment.

Cost-sharing was authorized for seed, seedbed preparation, seeding and fertilizers. Chemicals used in the practice were required to be federally and locally registered and applied in accordance with authorized registered user's directions and in compliance with other federal and state regulations. In selecting plant species and varieties, consideration was given to the needs of wildlife. Once established, vegetative cover was required to be maintained for a minimum of five years.

Components eligible for cost-share:

1. Fencing - 382
2. Pasture and Hayland Planting - 512
3. Range Seeding - 550
4. Planned Grazing System - 556

Components implemented as noncost-share:

1. Pasture and Hayland Management - 510
2. Proper Grazing Use - 528
3. Wildlife Upland Habitat Management - 645
4. Wildlife Wetland Habitat Management - 644

All cost-share practices under BMP 1 received 75% cost-share on the total cost of implementing the practice, with the exception of component 556 (Planned Grazing System) which was cost-shared at $1 per acre. Component 556 was cost-shared in only a few instances because it was a practice already employed by most producers.

Highlights of BMP 1
Components 382-Fencing and 556-Planned Grazing System were generally used to restrict access to the stream by livestock and were very beneficial in promoting streambank stabilization. Components 512-Pasture and Hayland Planting and 550 Range Seeding were very successful in enhancing revegetation, and healing drainageways on and off cropland areas. Wildlife benefits were increased under BMP 1.

Noncost-share Practices
Noncost-share practices under BMP 1 were planned into a contract wherever applicable. These were reviewed annually with each producer when SCS performed their status reviews.

Practice 510, Pasture and Hayland Management was designed to retain or improve the quality of forage which would then protect the soils. This practice involved a variety of situations including delayed grazing, clipping of pastures, fertilizing, or weed control.

Practice 528-Proper Grazing Use insured that the grazing intensity would maintain enough cover to protect soils and increase the vigor and reproduction of key plants.

Practice 645-Wildlife Upland Habitat Management was planned to maintain or enhance areas that provided suitable habitat for upland wildlife such as ring-necked pheasant, bobwhite quail, cottontail rabbit, squirrel, mourning dove, and nongame birds. Some activities involved excluding or managing livestock in ways that would maintain the habitat, and haying around these areas.

Practice 644-Wildlife Wetland Habitat Management addressed maintaining conditions suitable to waterfowl, furbearers or other wildlife. Activities often involved the protection of grassy-type vegetation surrounding the areas.

<u>BMP 2 Animal Waste Management Systems</u>
Total Cost-Share Received for BMP 2 = $27,182
% of Total RCWP Cost-Share = 3.2%

The purpose of BMP 2 was to improve water quality by providing facilities for the proper storage and handling of livestock and poultry waste. BMP 2 was applicable to areas outlined in each Water Quality Plan as contributing to water pollution and needing treatment

Cost-share was restricted to practices needed to install an adequate system consistent with state laws. Portable equipment and machinery were included in contracts where both of the following requirements were met: It was the most cost-effective method for accomplishing the water quality objective and adequate controls were exercised to preclude misuses of authority. Practices under BMP 2 were required to be maintained for a minimum of 10 years following the calendar year of installation. Systems were required to meet specificationss in the SCS Technical Guide.

Cost-sharing was authorized for:

*Conduits (limited to the amount needed to convey the liquids to the nearest acceptable disposal area or system). Approved types were: asbestos cement, vinylclad aluminum, plastic pipe and tubing, clay or concrete tile, and corrugated metal pipe buried underground.

*Liquid manure tanks or pits, if the pits or tanks contributed significantly to improving the quality of ground and surface water. If the liquid manure tank was constructed beneath a building, cost-sharing was limited to the floor and walls of the tank, providing the footings and sidewalls equaled or exceeded the specifications for outside tanks.

*Storage and diversion facilities, if they contributed significantly to maintaining or improving the quality of water.

*Construction of a diversion or terrace system which would divert runoff from drainage areas above or within the feedlot.

Cost-share was specifically not authorized for:

*Measures primarily for the prevention of air

pollution unless the measures also had water conservation benefits.

*Animal waste facilities that did not meet local or state regulations.

*Concrete feeding platforms or storage pit areas on which to store solid manure.

*Installations primarily for the operator's convenience.

Components eligible for cost-share:

1. Waste Management System - 312
2. Waste Storage Structure - 313
3. Critical Area Planting - 342
4. Waste Treatment Lagoon - 359
5. Diversion - 362
6. Fencing - 382
7. Filter Strips - 393
8. Grassed Waterway or Outlet - 412
9. Waste Storage Pond - 425

Components implemented as noncost-share:

1. Waste utilization - 633

All cost-share practices under BMP 2 received 75% cost-share on the total cost of implementing the practice.

Highlights of BMP 2
Where implemented, components under BMP 2 showed a significant improvement of water quality.

Noncost-share items: Practice 633, Waste Utilization was written into contracts implementing BMP 2 whenever possible. This provided for the use of agricultural waste on soils and vegetation suitable for the use of waste as a fertilizer.

Difficulties in Implementation of BMP 2
In order for a design to be approved under BMP 2, a number of time-consuming procedures were followed. In several instances entire projects were delayed until the following year while going through the process of design review and approval. Generally, the following steps were required before construction could begin.

1. A representative of SCS and NDEC met with the producer.

2. An SCS technician visited the site to determine need and feasibility.

3. SCS technician first surveyed and then designed the system.

4. The design was sent to a licensed engineer for approval.

5. Once approved, the design was reviewed with the producer.

6. The design was then sent to the SCS Field Office for review.

7. Once reviewed, the design was sent to the State SCS office for review.

8. The design was then sent to the NDEC for review and approval.
9. Once approved, construction could finally begin.

If at any time a design had to be modified or changed, the design had to go through the review and approval process from the beginning. It was generally felt by technicians and producers that if some of the steps could be eliminated or combined greater efficiency would be realized in implementing BMP 2.

Disappointments In Implementing BMP 2
As previously mentioned in "Water Quality Goals and Objectives", the LCC was greatly disappointed that they were unable to install Animal Waste Management Systems on the majority of feedlots within the critical area. According to the RCWP manual, an agricultural point source was defined as "farms with 1,000 or more animal units" or "portions of a farm for which EPA has issued a permit." Most of the feedlots in the critical area fell into these categories and therefore were ineligible for cost-share under BMP 2.

BMP 4 Terrace System
Total Cost-Share Received for BMP 4 was zero.

The purpose of BMP 4 was to improve water quality through the installation of terrace systems on farmland to prevent excessive runoff of water or soil loss contributing to water pollution. BMP 4 was applicable for cropland and intensively used areas that were creating a water quality hazard and therefore required special treatment.

Cost-share was authorized for: a terrace system, material and installation of underground pipe outlets and other mechanical outlets and necessary vegetative protective outlets or waterways. Practices were to be maintained for a minimum of 10 years following the calendar year of installation.

Components eligible for cost-share:

1. Grassed Waterway or Outlet - 412
2. Obstruction Removal - 500
3. Terrace - 600
4. Subsurface Drain - 606
5. Underground Outlet - 620

Difficulties in Implementation of BMP 4
BMP 4 was generally not applicable as the majority of the cropland in the Long Pine Creek Watershed was leveled in preparation for the Ainsworth Irrigation District Project. Most of the cropland throughout the watershed is now gravity irrigated or under center pivot irrigation. Terraces were generally not applicable to cropland under center pivot irrigation due to the topography and soil types.

BMP 5 Diversion System
Total Cost-Share Received for BMP 5 was $45,956
% of Total RCWP Cost-Share = 5.4%

The purpose of BMP 5 was to improve water quality by installing diversions on farm or ranchland where excess surface or subsurface water runoff contributed to a water pollution problem. BMP 5 was applicable on cropland and intensively used areas where a water quality problem existed.

Cost-sharing was authorized for earth moved for diversions and for required outlets and seeding. If earth moved in the construction of a diversion was being excavated by constructing a dugout, tailwater recovery or other type of structure where cost-sharing was already provided, cost-sharing on the earth moved in construction of the diversion was not authorized. The practice was required to be maintained for a minimum of 10 years following the calendar year of installation.

Components eligible for cost-share:

1. Diversion - 362
2. Underground outlet - 620
3. Subsurface Drain - 606

All cost-share practices under BMP 5 received 75% cost-share on the total cost of implementing the practice.

Highlights of BMP 5
Practices implemented under BMP 5 greatly improved conditions downstream by diverting water away from critical areas where it could be efficiently utilized.

Difficulties in Implementation of BMP 5
Difficulty in implementing BMP 5 included finding a location that would not present additional problems and the timing of the work. Work on diversions basically had to be performed in the spring or late fall due to the activity of producers.
Wet springs especially created a variety of problems for technicians and producers and often detained construction until the following year.

BMP 6 Grazing Land Protection System
Total Cost-Share Received for BMP 6 was $97,514
% of Total RCWP Cost-Share = 11.4%

The purpose of BMP 6 was to improve water quality through better grazing distribution and better grassland management by developing springs, seeps, wells, ponds or dugouts, and installing pipelines and storage facilities.

BMP 6 was applicable when needed to correct an existing problem causing water pollution which resulted from concentrations of livestock.

Cost-sharing was authorized for construction or deepening of wells, dugouts, installation of pipelines, casing and pipe installed in the casing, mill and towers where fencing was required to exclude livestock from the stream and spring development.

Wells were to be provided with pumping equipment (except for artesian wells) and adequate storage facilities. No cost-sharing was authorized for pumps, pumping equipment (except where livestock were excluded from streams) or for dry wells. Practices were to be maintained for a minimum of 10 years following the calendar year of installation.

Cost-sharing was specifically not authorized for any installation which was:

*Primarily for recreation, wildlife, dry lot feeding, corrals or barns.

*To make it possible to graze crop residues, field borders, or temporary or supplemental pasture crops.

*For land on which the cover would be used for hay or silage or green chopped feed.

*For the purpose of providing water for the farm or ranch headquarters.

Components eligible for cost-share:

1. Fencing - 382
2. Pipeline - 516
3. Trough or Tank - 614
4. Well - 642
5. Pond - 378
6. Pond Sealing or Lining - 521
7. Planned Grazing System - 556
8. Spring Development - 574
9. Proper Grazing Use - 528

All cost-share practices under BMP 6 received 75% cost-share on the total cost of implementing the practice, with the exception of component 556 (Planned Grazing System) which was cost-shared at $1 per acre. Component 556 was cost-shared in only a few instances because it was a practice already employed by most producers.

Highlights of BMP 6
Grazing Land Protection provided immediate relief to streambanks. Perennial grasses and the quality of grasses was greatly enhanced. In the beginning of the program, it was believed by SCS technicians that total and permanent livestock exclusion from the stream was necessary. However, as perennial grasses became established along streambanks it was found that limited grazing and access to streams made use of vegetation and did not harm the areas.

BMP 7 Waterway System
Total Cost-Share Received for BMP 7 was $8,965
% of Total RCWP Cost-Share = 1.0%

The purpose of BMP 7 was to improve water quality by installing a waterway to safely convey excess surface runoff across fields at nonerosive velocities into watercourses or impoundments. The waterway is protected from erosion and reduces pollution through filtering out silt with the establishment of sod cover of perennail grasses or legumes or both. BMP 7 was applicable to farmland needing permanent sod waterways to control erosion and reduce water pollution.

Cost-sharing was authorized for the required earth work and establishment of permanent vegetative cover. The seeded width of the waterway was constructed to carry the design flow plus additional width as needed for a turnrow or roadway. When establishing waterway protective measures, consideration was given to the protection of wildlife. Once vegetation was established, the practice was required to be maintained for a minimum of 10 years.

Components eligible for cost-share:

1. Fencing - 382
2. Grassed Waterway or Outlet - 412
3. Grade Stabilization Structure - 410
   (including Gabion)

All cost-share practices under BMP 7 received 75% cost-share on the total cost of implementing the practice.

Highlights of BMP 7
Once permanent vegetative cover was established on outlets, the waterway systems were very effective in controlling erosion sediment loadings.

Difficulties in Implemention of BMP 7
An experiment using Enkamat (a plastic mulch to aid in waterway revegetation and stabilization) resulted in the Enkamat being washed out and redone three times. The use of this material was abandoned.

BMP 8 Cropland Protective System

BMP 8 was a noncost-share item.

The purpose of BMP 8 was to improve water quality by providing needed protection from severe erosion on cropland in between crops or pending establishment of enduring protective vegetative cover. BMP 8 was applicable to all cropland needing protection to prevent sediment and chemical runoff from creating a water quality problem.
A good stand and cover had to be maintained on the land until the crop or protective vegetative cover was planted.

The lifespan of BMP 8 required that the acres be maintained for a minimum of one year or longer if it was not feasible for the crop or enduring protective vegetative crop to be planted due to drought or other reasons beyond the control of the producer.

Components implemented as noncost-share:

1. Conservation Cropping System - 328
2. Cover and Green Manure Crop - 340

Highlights of BMP 8
All practices under BMP 8 were noncost-share. A Cropland Protective System was implemented on all contracts with irrigated cropland.

Practice 328, Conservation Cropping System, required that producers plant crops that would leave adequate residue cover to prevent erosion or plant a cover crop following the harvest of a crop. Through this practice, water and wind erosion were kept to a minimum.

BMP 9 Conservation Tillage System

Total Cost-Share Received for BMP 9 = $3,060
% of Total RCWP Cost-Share = .4%

The purpose of BMP 9 was to improve water quality by the use of reduced tillage operations in producing a crop. The reduced tillage operations and crop residue management were required to be performed annually. BMP 9 was applicable to cropland devoted to the production of intertilled crops that were creating a water quality problem. Cost-sharing was authorized for three years and was limited to lands eroding at a rate greater than soil loss tolerance.

Cost-sharing was authorized for three years and the producer was required to carry out the practice each year thereafter until the contract had expired.

Chemicals used in performing this practice were required to be federally, state and locally registered and applied strictly in accordance with authorized registered user's directions and in compliance with other federal and state regulations that were applicable.

Eligible tillage operations were:

*Chisel plowing with other limited operations.

*Light tillage without plowing.

*Approved slot or strip tillage operations ahead of planter.

*Other similar methods.

Components eligible for cost-share:

1. Conservation Tillage System - 329

Components implemented as noncost-share:

1. Conservation Cropping System - 328
2. Crop Residue Use - 344
3. Contour Farming - 330

Cost-Share was authorized at $15 per acre if 75% or more of the soil surface was covered with crop residue after planting was completed and $10 per acre if 30-74% of soil surface was covered with crop residue after planting.

BMP 9 was not widely implemented as it was felt that a large number of producers in the area were already implementing conservation tillage systems on their farms. It was decided that with so much volunteer participation, the cost-share incentive was not necessary.

Noncost-share items: Noncost-share practices were written into every contract where high and low intensity crops were planted.

Practice 328, Conservation Cropping System was implemented to retain adequate cover to prevent water and wind erosion.

Practice 344, Crop Residue Use was implemented to protect cultivated fields from erosion with adequate crop residue cover from harvest until planting.

Practice 330, Contour Farming which involved planting along the contour slope of the land was not applicable to the area as most of the land had been leveled for gravity irrigation.

BMP 10 Stream Protection System
Total Cost-Share Received for BMP 10 = $45,616
% of Total RCWP Cost-Share = 5.3%

The purpose of BMP 10 was to improve water quality by protecting streams from sediment or chemical pollutants through the installation of vegetative filter strips, protective fencing, livestock crossings and mechanical (structural) practices.

BMP 10 was applicable to streams or lakes located on or adjacent to farmland which had sediment or chemical pollutants moving into waterways causing water quality problems. Consideration was given to wildlife and the environment in general when designing practices. The practices were required to be maintained for a minimum of 10 years following the installation of the practice.

Cost-sharing was authorized for:

*Permanent fencing that would protect banks from damage by domestic livestock.

*The planting of trees, shrubs or perennial grass cover as a filter along banks.

*Providing access to water for livestock.

*The installation of livestock crossings that would help retard sedimentation and pollution. (Where required, permits had to be obtained by the applicant before the practice was approved).

*The installation of instream sediment basins and grade stabilization structures (including gabions).

Components eligible for cost-share:

1. Channel Vegetation - 322
2. Fencing - 382
3. Filter Strips - 393
4. Streambank Protection - 580
5. Tree Planting - 612
6. Instream Sediment Basin - 350
7. Grade Stabilization Structure - 410 (including Gabions)

All cost-share practices under BMP 10 received 75% cost-share on the total cost of implementing the practice.

Highlights of BMP 10

<u>**Cedar Revetments**</u>

Cedar Revetments were one of the most innovative and successful practices implemented under RCWP. Revetments were constructed to control streambank erosion. However, they provided a variety of benefits to trout and other aquatic life in the stream.

Streambank erosion occurs mainly along bends in the creek where the current's velocity and erosive ability are the greatest. Revetments were built to protect banks from the erosive action of the stream. Cedar trees which lined the creeks and streams were ideal material for revetments. Their numerous branches were perfect for trapping sediment.

The revetments were constructed with Cedar trees, number 9 wire, 5/16" cable and steel fence posts. Steel posts were driven horizontally into the streambank about every 10 feet. A deadman post was set on the upstream end of the revetment and a 5/16" cable was attached to it. The cable was wired to the fenceposts. Cedar trees were placed horizontally in the stream in the direction of the flow and were then wired to the cable. The revetment deflected water away from the eroding streambank and began trapping sediment immediately after installation. Within a few days the revetment was filled with sediment.

The first revetments constructed were damaged by heavy rains and runoff. A method was needed to better stabilize and protect newly constructed revetments from heavy rains. SCS technicians decided to broadcast or sod Reed canarygrass onto the top of the trapped sediment as soon as the revetments had filled up. This proved to be extremely successful. Reed canarygrass is a deep rooted perennial plant that spread rapidly throughout the stream. The Canarygrass provided habitat for aquatic life and occasionally forage for livestock.

Revetments proved to be extremely beneficial to fish populations including trout. Revetments were constructed along bends in the creek where streambank erosion was critical. Within a few days the revetments had filled with sediment. This increased the velocity of the channel and created a deeper, narrower and cooler stream. The faster and deeper creek flushed out sand and sediment and reexposed gravel in the streambed necessary for trout spawning. Revetments gave trout a place to hide, feed and rest. A deeper and cooler stream is condusive to trout species and other aquatic life.
The NGPC and SCS used the Habitat Quality Index Procedures Manual (Binns 1982*) Model II methodology to document the amount of change in carrying capacity after revetment installation. According to this modeling system, cedar revetments have increased the mean carrying capacity of Long Pine Creek from 75.4 pounds/acre to 119.2 pounds/acre, a positive increase of 58.1 for the sites analyzed.

Difficulties in Implementation of BMP 10
Some problems were encountered in building Cedar revetments. Branches were originally used and proved to be ineffective. The entire Cedar tree was necessary to trap sediment along the eroding banks.

The first revetments suffered damage from beavers. Immediately after construction of a revetment, beavers would clean the branches off the trees and remove them. It became necessary to cut the trees prior to installation and let them dry out several months or even a year prior to installation.

A permit from the Corps of Engineers was required before construction of a revetment could be installed along the creek. These are not difficult to obtain but can become time-consuming as the permit process can take up to six months to complete. A General Permit was obtained through the NGPC General Permit. This permit was applicable for all revetment installations.

Although most of the critically eroding banks were addressed, SCS technicians now feel they could have constructed additional revetments. Many technicians feel that revetments should be included as an ACP practice. (For revetment construction information see "Revetment Construction Installation" in Appendix).

<u>BMP 11 Permanent Vegetative Cover on Critical Area</u>
Total Cost-Share Received for BMP 11 = $9.743
% of Total RCWP Cost-Share =1.1%

The purpose of BMP 11 was to improve water quality by installing measures to stabilize a source of sediment such as gullies, banks, privately owned roadsides, field borders or similar problem areas contributing to water pollution. BMP 11 was applicable to farmland that created a water quality hazard.

Cost-sharing was authorized for measures needed to stabilize critically eroding areas where vegetation was insufficient to control erosion. Acres treated were required to be maintained for a minimum of five years following completion of the practice.

Components eligible for cost-share:

1. Critical Area Planting - 342
2. Fencing - 382
3. Mulching - 484

All cost-share practices under BMP 11 received 75% cost-share on the total cost of implementing the practice.

<u>BMP 12 Sediment Retention, Erosion, or Water Control Structure</u>
Total Cost-Share Received for BMP 12 = $95,309
% of Total RCWP Cost-Share = 11.1%

The purpose of BMP 12 was to improve water quality through the control of erosion, including sediment and chemical runoff from specific problem areas. BMP 12 applied to areas of farmland that required structural measures to solve a water quality hazard.

Cost-sharing was authorized for approved components only if the measures would contribute to improving water quality. Consideration was given to the needs of wildlife when establishing the protective measures.

Cost-sharing was specifically not authorized for structures whose principal benefit would be flood retardation or irrigation. Structures were required to be maintained for a minimum of 10 years following installation.

Components eligible for cost-share:

1. Fencing - 382
2. Grade Stabilization Structures - 410 (including Gabions)
3. Structures for Water Control - 587
4. Sediment Basin - 350
5. Dike - 356
6. Water and Sediment Control Basin - 638
7. Critical Area Planting - 342

Highlights of BMP 12

Several small dams were constructed on farms to address gully erosion. They were primarily applied to small drainage areas on highly permeable soils and constructed only on rangeland. The smaller structures reduced the amount of sediment reaching Sand Draw Creek and stabilized the gullies. These took the place of larger, more expensive structures and proved to be very successful as well as cost-effective.

Difficulties in Implementation of BMP 12

BMP 12 created a variety of frustrations for SCS technical personnel. It was generally felt that there was a lack of support from upper levels and lack of acceptance of innovative, experimental practices that could have been implemented under BMP 12. It was felt that the SCC was reluctant to support the implementation of several innovative practices designed by field office personnel and did not recommend the use of other experimental practices adopted by other RCWP projects.

Sand Draw Structure: A tremendous amount of time and energy was spent on the planning and design of a proposed dam on Sand Draw. The Sand Draw watershed was identified early in the project as an area where the most intense streambank erosion was occurring.

RCWP funds were targeted for agricultural nonpoint source pollution control measures only. BMP 12 was approved for "areas of farmland that required structural measures to solve a water quality hazard." The Sand Draw structure was to be located away from farmland.

The LCC began pursuing the idea of a large structure on Sand Draw as early as 1983. In April, 1983 the SCC expressed concern that project efforts might be expended on other than agriculture nonpoint source problems, including the Sand Draw Structure.

In April, 1985, after reviewing the 1984 Annual Report, NCSU expressed concern that a major portion of the cost-share dollars were being directed towards non-agronomic practices (sediment structures). A further explanation as to why these structures merited so large a portion of the funds was requested to help in the analysis of the project. This was never made clear.

From 1986 to 1987 a great deal of time and energy was devoted to the proposed Sand Draw structure. In May of 1987, information on the proposed Sand Draw structure was sent to the state office and then on to Washington with a request for additional funding. This was not in the form of a proposal. An extensive explanation of the water quality benefits or nonpoint source pollution control that the structure would provide was not included.

In July of 1987 more information was requested from Washington on justification of the water quality benefits of the project.

The cost of the Sand Draw structure (excluding land rights) was then being estimated at over $1,000,000. In addition to utilizing all of the unobligated RCWP funds (approximately $425,000) and all of the unobligated technical assistance funds (108,316) the project would require additional funding - (250,000 in technical assistance funds and $138,000 as cost-share funds along with miscellaneous funding from other sources).

In October, 1987 the NCC denied the request for additional funds for the Sand Draw structure. The work group stated that "based on documentation submitted with the original request and the information furnished, the amount of water quality and conservation benefits do not justify either the cost or installation of the structure under RCWP."

The group suggested that additional efforts be made to implement greater on-farm irrigation water management and other BMPs where irrigation water runoff was contributing to the downstream water quality problem. They also suggested that funding for the structure be pursued as a PL-566 project.

BMP 13 Improving an Irrigation and/or Water Management System

Total Cost-Share Received for BMP 13 = $439,727
% of Total RCWP Cost-Share = 51.3%

The purpose of BMP 13 was to improve water quality on farmland under irrigation for which an adequate supply of suitable water was available on which irrigation would be continued, and on farmland with a critical area or source that significantly contributed to water quality problems.

BMP 13 was applicable to areas or fields on farmland where irrigation water being used for growing crops was causing a water quality hazard.

Cost-sharing was authorized for all approved components that would improve water quality, and for the installation of needed power lines to re-use pits from an already existing power source. Tailwater recovery ponds were required to be sealed to prevent leaching. The systems were required to be maintained for a minimum of 10 years following the installation.

Components eligible for cost-share:

1. Irrigation Water Conveyance - 428 (Nonreinforced concrete ditch and channel lining)
2. Irrigation Water Conveyance Pipeline - 430
3. Irrigation System - 443 (Surface and subsurface share)
4. Irrigation System - 447 (Tailwater Recovery including Power Lines, Pumps and Motors)
5. Irrigation Systems, Drip - 441
6. Irrigation Water Management - 449 (Including water management equipment)
7. Structures for Water Control - 587

Highlights of BMP 13

Practices implemented under BMP 13 were very costly. To encourage producers to install practices, more components were added such as pumps, gated pipe, powerlines etc.

Irrigation Tailwater Recovery Systems were very effective in managing irrigation runoff and in providing an efficient use of irrigation water. After additional funds for the Sand Draw structure were denied, a major effort was directed toward BMP 13.

A total of 51.3% of all cost-share funds were spent on BMP 13 (21.8% on the AID structure and 29.5% on farms). Most of these practices were not original items in the water quality plan. They were added as modifications as priorities in the program changed.

Ainsworth Irrigation District Project - Pooling

The largest project in the LPRCWP was the installation of the Ainsworth Irrigation District (AID) Secondary Storage Reservoir. AID delivers irrigation water to some 350 producers. Irrigation water is transported by a 53 mile concrete canal from Merritt Reservoir to 35,000 acres located within the watershed.

The distribution system at the end of the concrete canal originally consisted of 175 miles of earth lined laterals and canals, 5 miles of open drains and 35 farm disposal ponds for runoff. Through RCWP, many of the disposal ponds were converted to re-use ponds.

Prior to the construction of the reservoir, there was no way to divert the irrigation water in the 53 mile long canal. When fields were saturated by heavy rains it took 24-48 hours to shut down the water. Excess water and runoff would continue to move through fields already saturated by rainfall, carrying sediment and pollutants into the streams through natural drainageways.

With the construction of the Reservoir, water from the main canal could be diverted almost immediately. Producers served by AID were able to have their water shut off within 8 hours after a rain.

The reservoir has proven to be extremely beneficial and is used more frequently that was expected. In addition to reducing irrigation runoff, substantial economic benefits have been realized. According to Harlin D. Welch, AID manager, producers in 1989 and 1990 realized a direct savings of over $145,000.

Other benefits of the project include:

*Recharge of ground water from the reservoir.

*A longer recreation season at Merrit Reservoir due to less draw down in Merrit Reservoir.

*Less bank erosion from exposed beach.

*A reduction of the leaching of crop nutrients into the ground water.

The structure was a major undertaking. State and federal agencies joined forces and funds to complete the project. Eight producers joined together in a pooling agreement to provide RCWP funds for the project.

Construction costs were $249,319 ($186,994 through RCWP cost-share, $62,325 through the Natural Resource Commission and the Ainsworth Irrigation District).

Additional expenses were $20,155 in engineering costs which were provided by a transfer of technical funds from RCWP through MNNRD to fund the project; and a $20,000 land purchase by the Ainsworth Irrigation District.

BMP 14 Tree Planting

Total Cost-Share Received for BMP 14 = $20,200
% of Total RCWP Cost-Share = 2.4%

The purpose of BMP 14 was to improve water quality by planting trees to treat critical areas or sources contributing to water pollution. BMP 14 was applicable to areas of farmland where runoff created a water quality hazard.

Cost-sharing was authorized for planting trees and shrubs, fencing and irrigation drip systems that would contribute to improved water quality. Included in the drip irrigation system were wells, pumping equipment and pipe to the site at the discretion of the LCC. Once established, the practices were to be maintained for a minimum of 10 years.

Components eligible for cost-share:

1. Fencing - 382
2. Tree Planting - 612
3. Irrigation Systems, Drip - 441

<u>BMP 15 Residual Nitrate Management</u>
Total Cost-Share Received for BMP 15 = $19,237
% of Total RCWP Cost-Share = 2.2%

The purpose of BMP 15 was to improve water quality through the reduction of fertilizer application (without a dramatic loss in yields) in order to reduce the potential of nutrients leaching into the ground water source and entering surface water areas.

BMP 15 was applicable to land on which fertililzer was applied for the production of agricultural crops, including pasture and rangeland, that was contributing to water pollution problems.

The CES was responsible for technical phases of this practice and made recommendations to the producer based on the latest data available from the University of Nebraska (see Chapter 4 -I&E).

Cost-sharing was authorized for the first three years of this five year practice.

Components eligible for Cost-Share:

1. Fertilizer Management - 384
2. Waste Utilization - 633

Cost-share was $1 per acre for component 384 for the first three years of the practice and 75% of cost for testing nutrient under component 633.

Highlights of BMP 15
The intent of BMP 15 was to maximize nitrogen fertilizer use and minimize nitrogen leaching into the groundwater without suffering a yield loss. Crop production on sandy soils throughout the area required the extensive use of chemicals. Fertilizer usage in the late 1970s was approximately 180-220 pounds of nitrogen, 30-35 pounds of phosphate and 50-60 pounds of potassium per acre. The average corn yield on irrigated ground was approximately 130 bu. per acre.

The CES encouraged producers to apply fertilizer at rates recommended by the University of Nebraska rather than the rates recommended by fertilizer companies. University of Nebraska soils specialists believed in a "deficiency correction concept." This concept centers around the idea that there is a certain amount of fertilizer left in the soil following production of a crop. Soil testing would determine exactly how much fertilizer was left. Crop nutrients were recommended based on soil tests. With the use of irrigation scheduling, crops could utilize as much of the fertilizer as possible. Excessive and unnecessary use of fertilizers was eliminated, which in turn reduced the amount of nitrogen leaching into ground water and running off into surface water areas.

The CES workshops and demonstrations along with RCWP cost-sharing provided incentives for participation. Producers began saving $10 to $40 an acre the first year without sacrificing yields. Producers outside of the critical area began to adopt CES recommendations and reduced their applications of fertilizer. Each year fertilizer usage was reduced on thousands of acres that were not enrolled in RCWP (See Chapter 4-I&E, Demonstration Farm).

BMP 16 Pesticide Management
Total Cost-Share Received for BMP 16 = $18,338
% of Total Cost-Share = 2.1%

The purpose of BMP 16 was to improve water quality by reducing pesticide use to a minimum and to better manage pests in critical areas to achieve a minimum level of chemicals contributing to water pollution. BMP 16 was applicable to land where water pollution problems existed and where pesticides were used for insect control.

Chemicals had to be federally, state and locally registered and applied strictly in accordance with authorized registered user's directions and in compliance with other federal and state regulations.

CES was responsible for the technical phases of this practice and made recommendations to the operator based on the latest data from the University of Nebraska.

Cost-sharing was authorized for the first three years of the five year practice.

Components eligible for cost-share:

1. Pesticide Management - 514

Cost-share practices under BMP 16 were $1 per acre for the first three years of the practice.

Highlights of BMP 16
An offshoot of RCWP was the establishment of the farmer-operated Integrated Pest Management Association (IPM). The organization was established in March of 1983 by Paul Koerner, Extension Agent for the B-K-R CES, and is still active.

According to CES, the IPM concept involved scouting fields weekly for evidence of pest damage. Measures to control insect populations were applied when damage levels were apparent and reached the economic threshold (the point at which economic loss would occur if controls were not applied). Many damaging insects are effectively treated only during a brief period (a few days to a week). Scouting allowed producers to apply controls when insects were the most susceptible to treatment.

CES began publishing an Integrated Pest Management newsletter throughout each growing season.

The IPM newsletter:

*Offered IPM training sessions in the identification of pests;

*Provided weather and soil temperature reports;

*Alerted producers to potential insect problems;

*Kept producers abreast of application methods of various herbicides and pesticides.

Producers outside the critical area became interested and actively involved in IPM on their own farms. Producers began applying pesticides only when recommended instead of as an annual "insurance" against insects. The elimination of a single application provided a great savings to producers. In addition, timely applications provided for a much more efficient use of pesticides (see IPM Newsletter in Appendix).

Acres Served by each BMP, BMP Units Installed by Subbasin:

The following series of charts is a complete breakdown by year and by practice of everything that was achieved under each BMP within each subbasin. The charts address BMP, Practice Code and Description, Year, Cost-share, Acres Served, Units Applied and Misc. Unit.

"Units Applied" figure is the unit of measure that is required to be reported by SCS on the Conservation Reporting and Evaluation System (CRES) form. The miscellaneous unit is reported in cu. yds., number of trees, feet of powerline etc. These are units of interest that are not the required unit to be reported by SCS.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 1 ACRES IN CRITICAL AREA 1,218 CRITICAL ACRES UNDER CONTRACT 1,093
TOTAL COST SHARE $51,913 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 6.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 1 Permanent Vegetative Cover					
1	382 Fencing	1986	215	2	396 ft	
1	550 Range Seeding	1984	62	2	2 acres	
	Subtotal BMP 1		**277**			
	BMP 2 Animal Waste Management System					
2	313 Waste Storage Structure	1989	4,496	1	1 unit	
2	425 Waste Storage Pond	1991	1,786	1	1 pond	973 cuyds
	Subtotal BMP 2		**6,282**			
	BMP 5 Diversion System					
5	362 Diversion	1984	1,903	50	1,500 ft	2,000 cuyds
5	362 Diversion	1985	2,588	114	570 ft	698 cuyds
5	362 Diversion	1986	488	45	900 ft	433 cuyds
5	362 Diversion	1990	544	14	853 ft	639 cuyds
	Subtotal BMP 5		**5,523**	**223**	**3,823 ft**	**3,770** cuyds
	BMP 13 Improving an Irrigation and/or Water Management System					
13	430 Pipeline	1986	13,669	256	4,631 ft	
			(10,789)		(2,831 ft pipeline)	
			(2,880)		(1,800 ft gated pipe)	
13	447 Ir Sys Tailwater Recovery	1984	4,172	114	1 unit	1,559 cuyds
13	447 Ir Sys Tailwater Recovery	1985	9,167	129	1 unit	2,252 ft pwrline

SUBBASIN 1 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 1 ACRES IN CRITICAL AREA 1,218 CRITICAL ACRES UNDER CONTRACT 1,093
TOTAL COST SHARE $51,913 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 6.1%

BMP	PRACTICE CODE/DESCRIPTION		YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 13 Improving an Irrigation and/or Water Management System continued						
13	447	Ir Sys Tailwater Recovery	1986	8,492	198	1 unit	
				(4,341)			2 pumps
				(1,833)			2,000 cuyds
				(2,318)			1,427'pwrline
		Subtotal 447		**21,831**	**441**	**3 units**	
13	449	Ir Water Management	1984	528	276	276 acres	24tensiometers
		Subtotal BMP 13		**36,028**			
	BMP 15 Residual Nitrate Man						
15	384	Fertilizer Management	1986	565	565	565 acres	
15	384	Fertilizer Management	1987	676	676	676 acres	
15	384	Fertilizer Management	1988	660	660	660 acres	
		Subtotal BMP 15		**1,901**			
		BMP 16 Pesticide Management					
16	514	Pesticide Management	1984	256	256	256 acres	
16	514	Pesticide Management	1986	565	565	565 acres	
16	514	Pesticide Management	1987	676	676	676 acres	
16	514	Pesticide Management	1988	405	405	405 acres	
		Subtotal BMP 16		**1,902**			

NOTE: Some practices (mostly BMP 15 and BMP 16) were cost/shared in the year following the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 2 ACRES IN CRITICAL AREA 8,601 CRITICAL ACRES UNDER CONTRACT 5,430
TOTAL COST SHARE $103,687 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 12.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 2 Animal Waste Management Sys					
2	342 Critical Area Planting	1989	172	.5	.5 acres	
2	382 Fencing	1989	368	1	693 ft	
2	425 Waste Storage Pond	1988	3,263	1	1 pond	1,070 cuyds
2	425 Waste Storage Pond	1989	5,946	1	1 pond	
	Subtotal 425		9,209	2	2 ponds	
	Subtotal BMP 2		**9,749**			
	BMP 5 Diversion System					
5	362 Diversion	1986	8,758	119	2,315 ft	2,931 cuyds
5	362 Diversion	1989	5,212	38	1,324 ft	5,662 cuyds
	Subtotal BMP 5		**13,970**	**157**	**3,639 ft**	**8,593 cuyds**
	BMP 7 Waterway System					
7	412 Grassed Waterway or Outlet	1989	3,772	37	5 acres	

SUBBASIN 2 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 2 ACRES IN CRITICAL AREA 8,601 CRITICAL ACRES UNDER CONTRACT 5,430
TOTAL COST SHARE $103,687 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 12.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 11 Permanent Vegetative Cover On Critical Area					
11	342 Critical Area Planting	1985	313	4.5	4.5 acres	
11	342 Critical Area Planting	1986	828	7	9 acres	
11	342 Critical Area Planting	1987	61	1	1 acres	
11	342 Critical Area Planting	1989	100	1	2 acres	
11	342 Critical Area Planting	1991	32	1.5	1.5 acres	
	Subtotal 342		**1,334**	**15**	**18 acres**	
11	382 Fencing	1985	159	1	643.5 ft	
11	382 Fencing	1986	321	4	1,206 ft	
	Subtotal 382		**480**	**5**	**1,849 ft**	
11	484 Mulching	1986	414	3	6 acres	
11	484 Mulching	1989	147	1	1 acre	
	Subtotal 484		**561**	**4**	**7 acres**	
	Subtotal BMP 11		**2,375**			
	BMP 12 Sediment Retention, Erosion and/or Water Management Sys					
12	350 Sediment Basin	1988	3,262	1	1 unit	367 cuyds
12	410 Grade Stabilization Struc.	1991	20,215	64	2 units	9,492 cuyds
12	587 Structure for Water Control	1989	1,486	93	2 units	241 cuyds
12	638 Water & Sed Control Basin	1985	1,241	1	28 basins	6,000 cuyds

SUBBASIN 2 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 2 ACRES IN CRITICAL AREA 8,601 CRITICAL ACRES UNDER CONTRACT 5,430
TOTAL COST SHARE $103,687 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 12.1%

BMP	PRACTICE CODE/DESCRIPTION		YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 12 Sediment Retention, Erosion and/or Water Management Sys						
12	638	Water &Sed Control Basin	1986	1,594	330	11 basins	1,218 cuyds
		Subtotal 638		**2,835**	**331**	**39 basins**	**7,218 cuyds**
		Subtotal BMP 12		**27,798**			**17,318 cuyds**
	BMP 13 Improving an Irrigation and/or Water Management Sys						
13	430	Pipeline	1984	1,675	147	1,207 ft	
13	430	Pipeline	1987	1,249	43	1,195 ft	gated pipe
13	430	Pipeline	1988	8,852	81	1,914 ft	
13	430	Pipeline	1989	5,039	73	1,834 ft	
		Subtotal 430		**16,815**	**344**	**6,150 ft**	
13	447	Ir Sys Tailwater Recovery	1985	3,171	28	1 unit	1,963 cuyds
13	447	Ir Sys Tailwater Recovery	1987	6,479	99	1 unit	2,709 cuyds
13	447	Ir Sys Tailwater Recovery	1988	6,692	81	2 pumps	
13	447	Ir Sys Tailwater Recovery	1991	1,695	73	1 pump	
		Subtotal 447		**18,037**	**281**		**4,672 cuyds**
13	587	Structure for Water Control	1988	917	27	2 units	
		Subtotal BMP 13		**35,769**			

SUBBASIN 2 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 2 ACRES IN CRITICAL AREA 8,601 CRITICAL ACRES UNDER CONTRACT 5,430
TOTAL COST SHARE $103,687 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 12.1%

BMP	PRACTICE CODE/DESCRIPTION		YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 14 Tree Planting						
14	382	Fencing	1988	504	1.4	1,538 ft	
14	382	Fencing	1989	1,134	5	3,890.7 ft	
		Subtotal 382		**1,638**	**6.4**	**5,428.7 ft**	
14	441	Ir Drip System	1988	803	1	1 unit	
14	612	Tree Planting	1988	325	1	1 acre	711 trees
14	612	Tree Planting	1989	435	1	1 acre	462 trees
14	612	Tree Planting	1990	38	1	1 acre	80 replants
		Subtotal 612		**798**	**3**	**3 acres**	**1,253 trees**
		Subtotal BMP 14		**3,239**			
	BMP 15 Residual Nitrate Man.						
15	384	Fertilizer Management	1983	98	98	98 acres	
15	384	Fertilizer Management	1984	147	147	147 acres	
15	384	Fertilizer Management	1986	459	459	459 acres	
15	384	Fertilizer Management	1987	1,213	1,213	1,213 acres	
15	384	Fertilizer Management	1988	754	754	754 acres	
15	384	Fertilizer Management	1989	489	489	489 acres	
15	384	Fertilizer Management	1990	443	443	443 acres	
		Subtotal BMP 15		**3,603**			

SUBBASIN 2 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 2 ACRES IN CRITICAL AREA 8,601 CRITICAL ACRES UNDER CONTRACT 5,430
TOTAL COST SHARE $103,687 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 12.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1983	98	98	98 acres	
16	514 Pesticide Management	1984	147	147	147 acres	
16	514 Pesticide Management	1986	459	459	459 acres	
16	514 Pesticide Management	1987	1,213	1,213	1,213 acres	
16	514 Pesticide Management	1988	754	754	754 acres	
16	514 Pesticide Management	1989	298	298	298 acres	
16	514 Pesticide Management	1990	443	443	443 acres	
	Subtotal BMP 16		**3,412**			

NOTE: Some practices (mostly BMP 15 and BMP 16) were cost/shared in the year following the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 3 ACRES IN CRITICAL AREA 305 CRITICAL ACRES UNDER CONTRACT 250
TOTAL COST SHARE $43,621 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 5.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 2 Animal Waste Management Sys					
2	312 Waste Management System	1988	5,955	8	1 unit	
2	362 Diversion	1988	2,598	8	1,964 ft	
2	425 Waste Storage Pond	1988	2,598	8	2 ponds	5,553cuyds
	Subtotal BMP 2		11,151			
	BMP 5 Diversion System					
5	620 Underground Outlet	1990	2,186	79	620 ft	
	BMP 11 Permanent Vegetative Cover on Critical Area					
11	342 Critical Area Planting	1987	95	3	3 acres	

SUBBASIN 3 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 3 ACRES IN CRITICAL AREA 3Ø5 CRITICAL ACRES UNDER CONTRACT 25Ø
TOTAL COST SHARE $43,621 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 5.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 13 Improving an Irrigation and/or Water Management System					
13	43Ø Pipeline	1986	7,984	54	1,85Ø ft (1,Ø5Ø ft pipeline) (8ØØ ft gated pipe)	
13	43Ø Pipeline	1987	4,361	8	1,531 ft	
13	43Ø Pipeline	1989	6,964	79	2,42Ø ft	
	Subtotal 43Ø		**19,3Ø9**	**141**	**5,8Ø1 ft**	
13	447 Ir Sys Tailwater Recovery	1986	3,451	54	1 unit	1,8ØØ cuyds
13	447 Ir Sys Tailwater Recovery	1989	6,Ø95	79	1 unit	1 pump
	Subtotal 447		**9,546**	**133**	**1 units**	47Ø'pwrline
	Subtotal BMP 13		**28,855**			
	BMP 15 Residual Nitrate Man					
15	384 Fertilizer Management	1986	235	235	235 acres	
15	384 Fertilizer Management	1987	217	217	217 acres	
15	384 Fertilizer Management	1988	215	215	215 acres	
	Subtotal BMP 15		**667**			

SUBBASIN 3 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 3 ACRES IN CRITICAL AREA 3Ø5 CRITICAL ACRES UNDER CONTRACT 25Ø
TOTAL COST SHARE $43,621 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 5.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1986	235	235	235 acres	
16	514 Pesticide Management	1987	217	217	217 acres	
16	514 Pesticide Management	1988	215	215	215 acres	
	BMP 16 Subtotal		**667**			

NOTE: Some Practices (mostly BMP 15 and BMP 16) were cost/shared in the year following the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 4 ACRES IN CRITICAL AREA 5,155 CRITICAL ACRES UNDER CONTRACT 3,8Ø5
TOTAL COST SHARE $48,Ø51 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 5.6%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 1 Permanent Vegetative Cover on Critical Area					
1	512 Pasture & Hayland Planting	1987	39	2	2 acres	
	BMP 5 Diversion System					
5	362 Diversion	1986	389	2	24Ø ft	11Ø cuyds
	BMP 11 Permanent Vegetative Cover On Critical Area					
11	382 Fencing	1983	281	1.5	8Ø8.5 ft	
	BMP 12 Sediment Retention, Erosion and/or Water Management Sys					
12	382 Fencing	1985	416	1	1,ØØ6.5 ft	
12	587 Structure for Water Control	1989	642	32	2 acres	3.8 cuyds
12	638 Water & Sed Control Basin	1984	9,698	1	1 basin	5,2ØØ cuyds
	Subtotal BMP 12		**1Ø,756**			

SUBBASIN 4 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 4 ACRES IN CRITICAL AREA 5,155 CRITICAL ACRES UNDER CONTRACT 3,805
TOTAL COST SHARE $48,051 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 5.6%

BMP	PRACTICE CODE/DESCRIPTION		YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 13 Improving an Irrigation and/or Water Management System						
13	430	Pipeline	1982	3,433	125	1,515.5 ft	
13	430	Pipeline	1987	2,654	101	2,381 ft	
13	430	Pipeline	1989	1,466	32	460 ft	
13	430	Pipeline	1990	1,384	46	1,120 ft	
		Subtotal 430		**8,937**	**304**	**5,476.5 ft**	
13	447	Ir Sys Tailwater Recovery	1982	3,823	125	1 unit	1,335 cuyds
13	447	Ir Sys Tailwater Recovery	1985	2,495	125	1 unit	1 pump
13	447	Ir Sys Tailwater Recovery	1987	3,806	42	1 unit	1,431 cuyds
13	447	Ir Sys Tailwater Recovery	1990	8,246	112	2 unit	2 pumps 170'pwrline
		Subtotal 447		**18,370**			
13	587	Structure for Water Cotrol	1987	290	101	2 units	
13	587	Structure for Water Control	1991	1,100	46	1 unit	
		Subtotal 387		**1,390**	**147**	**3 units**	
		Subtotal BMP 13		**28,697**			

SUBBASIN 4 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 4 ACRES IN CRITICAL AREA 5,155 CRITICAL ACRES UNDER CONTRACT 3,8Ø5
TOTAL COST SHARE $48,Ø51 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 5.6%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 14 Tree Planting					
14	382 Fencing	199Ø	4Ø1	12	1,337 ft	
	BMP 15 Residual Nitrate Man					
15	384 Fertilizer Management	1983	125	125	125 acres	
15	384 Fertilizer Management	1984	62	62	62 acres	
15	384 Fertilizer Management	1986	846	846	846 acres	
15	384 Fertilizer Management	1987	1,319	1,319	1,319 acres	
15	384 Fertilizer Management	1988	951	951	951 acres	
15	384 Fertilizer Management	1989	81	81	81 acres	
15	384 Fertilizer Management	1991	72Ø	72Ø	72Ø acres	
	Subtotal BMP 15		**4,1Ø4**			
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1983	125	125	125 acres	
16	514 Pesticide Management	1984	62	62	62 acres	
16	514 Pesticide Management	1986	846	846	846 acres	
16	514 Pesticide Management	1987	1,319	1,319	1,319 acres	
16	514 Pesticide Management	1988	951	951	951 acres	
16	514 Pesticide Management	1989	81	81	81 acres	
	Subtotal BMP 16		**3,384**			

NOTE: Some practices (mostly BMP 15 and BMP 16) were cost/shared in the year following the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 5 ACRES IN CRITICAL AREA 6,620 CRITICAL ACRES UNDER CONTRACT 3,851
TOTAL COST SHARE $62,463 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.3%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 5 Diversion System					
5	362 Diversion	1985	5,158	20	1,868 ft	3,093 cuyds
	BMP 6 Grazing Land Protection Sys					
6	516 Pipeline	1989	1,799	115	2,180 ft	
6	516 Pipeline	1990	4,426	273	4,610 ft	
	Subtotal 516		**6,225**	**388**	**6,790 ft**	
6	614 Tanks	1989	218	115	1 tank	
6	614 Tanks	1990	675	293	3 tanks	
	Subtotal 614		**893**	**408**	**4 tanks**	
6	642 Wells	1990	1,992	293	1 well	
	Subtotal BMP 6		**9,110**			
	BMP 7 Waterway System					
7	342 Critical Area Planting	1985	38	1	1 acre	

SUBBASIN 5 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 5 ACRES IN CRITICAL AREA 6,620 CRITICAL ACRES UNDER CONTRACT 3,851
TOTAL COST SHARE $62,463 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.3%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 11 Permanent Vegetative Cover On Critical Area					
11	342 Critical Area Planting	1986	44	1	1 acre	
	BMP 13 Improving an Irrigation and/or Water Management System					
13	430 Pipeline	1986	9,130	66	2,082 ft	
			(5,485)		(732 ft pipeline)	
			(3,645)		(1,350 ft gated pipe)	
13	430 Pipeline	1987	2,800	280	1,620 ft	
			(502)		(210 ft pipeline)	
			(2,298)		(1,410 ft gated pipe)	
13	430 Pipeline	1989	1,174	59	774 ft	
13	430 Pipeline	1990	2,300	84	1,180 ft	
	Subtotal 430		**15,404**	**489**	**5,656 ft**	
			(9,461)		**(2,896 ft pipeline)**	
			(5,943)		**(2,760 ft gated pipe)**	

SUBBASIN 5 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 5   ACRES IN CRITICAL AREA 6,62Ø   CRITICAL ACRES UNDER CONTRACT 3,851
TOTAL COST SHARE $62,463   PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.3%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 13 Improving an Irrigation and/or Water Management System					
13	447 Ir Sys Tailwater Recovery	1985	14,635	27	1 unit	
			(1,834)			1 pump
			(8,123)			2,99Ø'pwrline
			(4,678)			3,ØØØ cuyds
13	447 Ir Sys Tailwater Recovery	1986	5,683	66	1 unit	
			(2,391)			1 pump
			(3,292)			2,17Ø cuyds
13	447 Ir Sys Tailwater Recovery	1987	6,959	187	1 unit	1 pump
						2,425'pwrline
	Subtotal 447		27,277			
	Subtotal BMP 13		42,681			3 pumps
						5,17Ø cuyds
						5,415'pwrline
	BMP 14 Tree Planting					
14	382 Fencing	1988	743	1	1,64Ø ft	
14	382 Fencing	1989	75	1	38Ø ft	
14	382 Fencing	199Ø	462	.8	1,462 ft	
	Subtotal 382		1,28Ø	2.8	3,482 ft	

SUBBASIN 5 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 5 ACRES IN CRITICAL AREA 6,620 CRITICAL ACRES UNDER CONTRACT 3,851
TOTAL COST SHARE $62,463 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.3%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 14 Tree Planting					
14	612 Tree Planting	1988	188	1.2	1.2 acres	413 trees
14	612 Tree Planting	1989	104	1	1 acre	197 trees
14	612 Tree Planting	1990	194	2	2 acres	462 trees (103 replants)
14	612 Tree Planting	1991	16	1	1 acre	50 replants
	Subtotal 612		**502**	**5.2**	**5.2 acres**	**1,122 trees (183 replants)**
	Subtotal BMP 14		**1,782**			
	BMP 15 Residual Nitrate Man					
15	384 Fertilizer Management	1986	448	448	448 acres	
15	384 Fertilizer Management	1987	542	542	542 acres	
15	384 Fertilizer Management	1988	542	542	542 acres	
15	384 Fertilizer Management	1989	118	118	118 acres	
15	384 Fertilizer Management	1990	175	175	175 acres	
	Subtotal BMP 15		**1,825**			

SUBBASIN 5 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 5 ACRES IN CRITICAL AREA 6,620 CRITICAL ACRES UNDER CONTRACT 3,851
TOTAL COST SHARE $62,463 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.3%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1984	118	118	118 acres	
16	514 Pesticide Management	1986	448	448	448 acres	
16	514 Pesticide Management	1987	542	542	542 acres	
16	514 Pesticide Management	1988	542	542	542 acres	
16	514 Pesticide Management	1990	175	175	175 acres	
	Subtotal BMP 16		1,825			

NOTE: Some practices (mostly BMP 15 and BMP 16) were cost/shared in the year following the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 6 ACRES IN CRITICAL AREA 7,736 CRITICAL ACRES UNDER CONTRACT 4,936
TOTAL COST SHARE $87,Ø26 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 1Ø.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 1 Permanent Vegetative Cover on Critical Area					
1	382 Fencing	1988	4Ø4	47	1,436 ft	
1	55Ø Range Seeding	1987	4,697	19Ø	19Ø acres	
1	55Ø Range Seeding	1988	8,873	19Ø	19Ø acres	
	Subtotal 55Ø		**13,57Ø**	**38Ø**	**38Ø acres**	
1	556 Planned Grazing System	1986	632	632	632 acres	
	Subtotal BMP 1		**14,6Ø6**			
	BMP 5 Diversion System					
5	362 Diversion	1986	2,449	24	1,3ØØ ft	97Ø cuyds
5	362 Diversion	1987	6ØØ	47	411 ft	978 cuyds
	Subtotal 362		**3,Ø49**	**71**	**1,711 ft**	**1,948 cuyds**
	BMP 6 Grazing Land Protection Sys					
6	382 Fencing	1986	5,338	1,736	11,781.8 ft	
6	382 Fencing	1987	841	21Ø	1,633.5 ft	
6	382 Fencing	1991	956	246	2,955.2 ft	
	Subtotal 382		**7,135**	**2,192**	**16,37Ø.5 ft**	

SUBBASIN 6 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 6 ACRES IN CRITICAL AREA 7,736 CRITICAL ACRES UNDER CONTRACT 4,936
TOTAL COST SHARE $87,Ø26 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 1Ø.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 6 Grazing Land Protection Sys					
6	516 Pipeline	1986	2,115	391	1,767 ft	
6	614 Tanks	1985	248	599	1 tank	
6	614 Tanks	1986	863	637	2 tanks	
	Subtotal 614		**1,111**	**1,236**	**3 tanks**	
6	642 Wells	1985	3,3Ø5	599	1 well	
6	642 Wells	1986	3,823	314	1 well	
	Subtotal 642		**7,128**	**913**	**2 wells**	
	Subtotal BMP 6		**17,489**			
	BMP 7 Waterway System					
7	342 Critical Area Planting	1984	375	5	5 acres	
7	412 Grassed Waterway or Outlet	1984	3,318	85	5 acres	
	Subtotal BMP 7		**3,693**			
	BMP 9 Conservation Tillage System					
9	329 Conservation Tillage System	1985	1,9ØØ	19Ø	19Ø acres	

SUBBASIN 6 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 6 ACRES IN CRITICAL AREA 7,736 CRITICAL ACRES UNDER CONTRACT 4,936
TOTAL COST SHARE $87,026 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 10.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 10 Stream Protection System					
10	322 Channel Vegetation	1985	359	5	5 acres	
10	322 Channel Vegetation	1988	161	1	1 acre	
	Subtotal 322		**520**	**6**	**6 acres**	
10	580 Streambank Protection Sys	1989	748	1	180 ft	
	Subtotal BMP 10		**1,268**			
	BMP 11 Permanent Vegetative Cover on Critical Area					
11	342 Critical Area Planting	1985	742	7.5	7.5 acres	
11	342 Critical Area Planting	1986	2,503	4	4 acres	
11	342 Critical Area Planting	1987	68	2	2 acres	
11	342 Critical Area Planting	1988	126	1	1 acre	
11	342 Critical Area Planting	1991	20	1	1 acre	
	Subtotal BMP 11		**3,459**		15.5 acres	
	BMP 12 Sediment Retention, Erosion and/or Water Management Sys					
12	410 Grade Stabilization Struc.	1985	20,074	40	1 unit	14,269 cuyds
12	410 Grade Stabilication Struc.	1987	3,957	35	1 unit	976 cuyds
	Subtotal 410		**24,031**	**75**	**2 units**	**15,245 cuyds**

SUBBASIN 6 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 6 ACRES IN CRITICAL AREA 7,736 CRITICAL ACRES UNDER CONTRACT 4,936
TOTAL COST SHARE $87,026 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 10.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 12 Sediment Retention, Erosion and/or Water Management Sys					
12	587 Structure for Water Control	1991	1,303	1	1 acre	1,330 cuyds
	Subtotal BMP 12		**25,334**			
	BMP 13 Improving an Irrigation and/or Water Management System					
13	430 Pipeline	1987	2,390	121	1,790 ft	
13	430 Pipeline	1990	2,460	46	912 ft	gated pipe
	Subtotal 430		**4,850**	**167**	**2,702 ft**	
13	447 Ir Sys Tailwater Recovery	1987	9,648	121	1 unit	1,200 cuyds 1 pump
	Subtotal BMP 13		**14,498**			

SUBBASIN 6 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 6 ACRES IN CRITICAL AREA 7,736 CRITICAL ACRES UNDER CONTRACT 4,936
TOTAL COST SHARE $87,026 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 10.1%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 15 Residual Nitrate Man					
15	384 Fertilizer Management	1984	619	619	619 acres	
15	384 Fertilizer Management	1986	232	232	232 acres	
15	384 Fertilizer Management	1987	21	21	21 acres	
15	384 Fertilizer Management	1990	89	89	89 acres	
	Subtotal BMP 15		**961**			
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1984	427	427	427 acres	
16	514 Pesticide Management	1986	232	232	232 acres	
16	514 Pesticide Management	1987	21	21	21 acres	
16	514 Pesticiee Management	1990	89	89	89 acres	
	Subtotal BMP 16		**769**			

NOTE: Some practices (mostly BMP 15 and BMP 16) were cost/shared in the year following the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 7 ACRES IN CRITICAL AREA 3,399 CRITICAL ACRES UNDER CONTRACT 2,559
TOTAL COST SHARE $15,710 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 1.8%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 5 Diversion System					
5	362 Diversion	1984	4,175	20	920 ft	1,516 cuyds
	BMP 6 Grazing Land Protection Sys					
6	614 Tank	1989	464	385	1 tank	
6	642 Well	1989	5,416	385	1 well	
	Subtotal BMP 6		**5,880**			
	BMP 10 Stream Protection System					
10	382 Fencing	1987	338	46	1,405 ft	
10	580 Streambank Protection Sys	1986	1,013	1	570 ft	
	Subtotal BMP 10		**1,351**			
	BMP 13 Improving an Irrigation and/or Water Management Sytstem					
13	447 Ir Sys Tailwater Recovery	1990	3,741	1	1 unit	1,575 cuyds

SUBBASIN 7 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 7 ACRES IN CRITICAL AREA 3,399 CRITICAL ACRES UNDER CONTRACT 2,559
TOTAL COST SHARE $15,710 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 1.8%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 13 Improving and Irrigation and/or Water Management System					
13	587 Structure for Water Control	1990	227	134	1 unit	.75 cuyds
	Subtotal BMP 13		**3,968**			
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1984	209	209	209 acres	
16	514 Pesticide Management	1986	127	127	127 acres	
	Subtotal BMP 16		**336**			

NOTE: Some practices (mostly BMP 15 and BMP 16) were cost/shared in the year following the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 8 ACRES IN CRITICAL AREA 2,406 CRITICAL ACRES UNDER CONTRACT 1,806
TOTAL COST SHARE $20,525 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 2.4%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 1 Permanent Vegetative Cover on Critical Area					
1	512 Pasture & Hayland Planting	1985	1,334	38	38 acres	
1	512 Pasture & Hayland Planting	1987	334	11	11 acres	
	Subtotal BMP 1		**1,668**	**49**	**49 acres**	
	BMP 6 Grazing Land Protection Sys					
6	614 Tanks	1984	278	246	1 tank	
6	642 Wells	1984	1,919	246	1 well	
	Subtotal BMP 6		**2,197**			
	BMP 9 Conservation Tillage System					
9	329 Conservation Tillage System	1987	1,160	116	116 acres	
	BMP 10 Stream Protection System					
10	382 Fencing	1984	1,157	2	3,377 ft	
10	580 Streambank Protection Sys	1985	7,017	7	4,051 ft	
10	580 Streambank Protection Sys	1986	626	1	1,845 ft	
10	580 Streambank Protection Sys	1987	946	2	904 ft	
	Subtotal 580		**8,589**	**10**	**6,800 ft**	
	Subtotal BMP 10		**9,746**			

SUBBASIN 8 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 8 ACRES IN CRITICAL AREA 2,4Ø6 CRITICAL ACRES UNDER CONTRACT 1,8Ø6
TOTAL COST SHARE $2Ø,525 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 2.4%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 11 Permanent Vegetative Cover on Critical Area					
11	342 Critical Area Planting	1985	16	1	1 acre	
11	342 Critical Area Planting	1986	545	2	2 acres	
11	342 Critical Area Planting	1987	59	1	1 acre	
	Subtotal 342		**62Ø**	**4**	**4 acres**	
11	484 Mulching	1987	213	7	7 acres	
	Subtotal BMP 11		**833**			
	BMP 12 Sediment Retention, Erosion an/or Water Management Sys					
12	35Ø Sediment Basin	1986	2,88Ø	196	1 unit	3,132 cuyds
	BMP 14 Tree Planting					
14	382 Fencing	1984	18.5Ø	1	518 ft	
14	382 Fencing	1987	4Ø8	17	1,567.5 ft	
14	382 Fencing	1988	229	1	7Ø9.5 ft.	
	Subtotal 382		**655.5Ø**	**19**	**2,795 ft.**	

SUBBASIN 8 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 8 ACRES IN CRITICAL AREA 2,406 CRITICAL ACRES UNDER CONTRACT 1,806
TOTAL COST SHARE $20,525 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 2.4%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 14 Tree Planting					
14	612 Tree Planting	1982	380	3	3 acres	1,000 trees
14	612 Tree Planting	1984	361.50	6	6 acres	1,250 trees
14	612 Tree Planting	1985	183	2	2 acres	400 trees
14	612 Tree Planting	1986	159	1	1 acre	375 trees
14	612 Tree Planting	1987	82	1	1 acre	300 replants
	Subtotal 612		**1,165.50**	**13**	**13 acres**	**3,325 trees**
	Subtotal BMP 14		**1,821**			
	BMP 15 Residual Nitrate Man					
15	384 Fertilizer Management	1987	110	110	110 acres	
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1987	110	110	110 acres	

NOTE: Some practices (mostly BMP 15 and BMP 16) were cost/shared in the year followig the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 9 ACRES IN CRITICAL AREA 5,114 CRITICAL ACRES UNDER CONTRACT 2,414
TOTAL COST SHARE $31,645 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 3.7%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 5 Diversion Sytstem					
5	362 Diversion	1990	2,265	32	1,100 ft	772 cuyds
	BMP 6 Grazing Land Protection Sys					
6	378 Pond	1990	2,873	1	1 pond	2,718 cuyds
6	382 Fencing	1984	417	372	1,303.5 ft	
	Subtotal BMP 6		**3,290**			
	BMP 13 Improving an Irrigation and/or Water Management System					
13	430 Pipeline	1985	3,234	76	1,886 ft	
13	430 Pipeline	1990	143	124	76 ft	
	Subtotal 430		**3,377**	**200**	**1,962 ft**	
13	447 Ir Sys Tailwater Recovery	1985	12,379	76	1 unit	
			(10,009)			2,439 cuyds
			(2,370)			1 pump
13	447 Ir Sys Tailwater Recovery	1990	6,054	76	1 unit	1 pump
						1,320'pwrline
	Subtotal 447		18,433			
	Subtotal BMP 13		21,810			

SUBBASIN 9 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 9 ACRES IN CRITICAL AREA 5,114 CRITICAL ACRES UNDER CONTRACT 2,414
TOTAL COST SHARE $31,645 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 3.7%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 15 Residual Nitrate Man					
15	384 Fertilizer Management	1984	117	117	117 acres	
15	384 Fertilizer Management	1986	615	615	615 acres	
15	384 Fertilizer Management	1987	549	549	549 acres	
15	384 Fertilizer Management	1988	264	264	264 acres	
15	384 Fertilizer Management	1989	432	432	432 acres	
15	384 Fertilizer Management	1990	163	163	163	
	Subtotal BMP 15		**2,140**			
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1984	117	117	117 acres	
16	514 Pesticide Management	1986	615	615	615 acres	
16	514 Pesticide Management	1987	549	549	549 acres	
16	514 Pesticide Management	1988	264	264	264 acres	
16	514 Pesticide Management	1989	432	432	432 acres	
16	514 Pesticide Management	1990	163	163	163 acres	
	Subtotal BMP 16		**2,140**			

NOTE: Some practices (mostly BMP 15 and BMP 16) were cost/shared in the year followig the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 10 ACRES IN CRITICAL AREA 5,711 CRITICAL ACRES UNDER CONTRACT 3,211
TOTAL COST SHARE $65,440 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.6%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 1 Permanent Vegetative Cover On Critical Area					
1	550 Range Seeding	1982	1,823	65	65 acres	
1	550 Range Seeding	1983	1,734	65	65 acres	
1	550 Range Seeding	1984	956	32	32 acres	
1	550 Range Seeding	1991	356	20	20 acres	
	Subtotal 550		**4,869**	**182**	**182 acres**	
1	556 Planned Grazing System	1987	225	225	225 acres	
	Subtotal BMP 1		**5,094**			
	BMP 6 Grazing Land Protection Sys					
6	382 Fencing	1984	573	158	2,079.1 ft	
6	382 Fencing	1985	1,046	225	2,691 ft	
6	382 Fencing	1986	633	134	2,190 ft	
6	382 Fencing	1988	1,673	11	5,049 ft	
6	382 Fencing	1989	440	77	870 ft	
	Subtotal 382		**4,365**	**605**	**12,879.1 ft**	
6	516 Pipeline	1984	512	25	450 ft	

SUBBASIN 10 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 10 ACRES IN CRITICAL AREA 5,711 CRITICAL ACRES UNDER CONTRACT 3,211
TOTAL COST SHARE $65,440 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.6%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 6 Grazing Land Protection Sys					
6	614 Tanks	1983	263	30	1 tank	
6	614 Tanks	1984	206	25	1 tank	
6	614 Tanks	1985	337	225	1 tank	
6	614 Tanks	1988	840	191	4 tanks	
6	614 Tanks	1990	1,006	358	4 tanks	
	Subtotal 614		**2,652**	**829**	**11 tanks**	
6	642 Wells	1983	1,047	30	1 well	
6	642 Wells	1984	4,491	81	2 wells	
6	642 Wells	1985	2,286	225	1 well	
6	642 Wells	1988	4,826	191	2 wells	
6	642 Wells	1990	3,189	358	2 wells	
	Subtotal 642		**15,839**	**885**	**8 wells**	
	Subtotal BMP 6		**23,368**			
	BMP 10 Stream Protection System					
10	382 Fencing	1985	1,297	54	3,231 ft	

SUBBASIN 10 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 10 ACRES IN CRITICAL AREA 5,711 CRITICAL ACRES UNDER CONTRACT 3,211
TOTAL COST SHARE $65,440 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.6%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 10 Stream Protection System					
10	580 Streambank Protection	1984	844	2	339 ft	
10	580 Streambank Protection	1985	1,195	1	750 ft	
10	580 Streambank Protection	1986	6,248	7	2,413.4 ft	
10	580 Streambank Protection	1989	358	1	225 ft	
	Subtotal 580		**8,645**	**11**	**3,727.4 ft**	
	Subtotal BMP 10		**9,942**			
	BMP 11 Permanent Vegetative Cover on Critical Area					
11	342 Critical Area Planting	1984	188	1	1 acre	
	BMP 12 Sediment Retention, Erosion and/or Water Management Sys					
12	342 Critical Area Planting	1986	44	2	2 acres	
12	410 Grade Stabilization Struc	1987	8,493	123	1 unit	4,866 cuyds
12	638 Water & Sed Control Basin	1986	254	14	2 units	
	Subtotal BMP 12		**8,791**			

SUBBASIN 10 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 10 — ACRES IN CRITICAL AREA 5,711 — CRITICAL ACRES UNDER CONTRACT 3,211

TOTAL COST SHARE $65,440 — PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.6%

BMP	PRACTICE CODE/DESCRIPTION		YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 13 Improving and Irrigation and/or Water Management System						
13	430	Pipeline	1986	2,582	106	1,208 ft	
13	447	Ir Sys Tailwater Recovery	1986	660	106	1 unit	1,545 cuyds
13	447	Ir Sys Tailwater Recovery	1989	4,493	69	1 unit	1 pump
		Subtotal 447		**5,153**	**175**		
13	449	Irrigation Water Management	1985	5,006	106	106 acres	1,050 cuyds
13	587	Structure for Water Control	1985	3,870	106	12 units	
		Subtotal BMP 13		**16,611**			
	BMP 14 Tree Planting						
14	612	Tree Planting	1989	645	1.7	1.7 acres	825 trees
14	612	Tree Planting	1990	263	1.6	1.6 acres	650 trees
		Subtotal BMP 14		**908**			

SUBBASIN 10 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 10 ACRES IN CRITICAL AREA 5,711 CRITICAL ACRES UNDER CONTRACT 3,211
TOTAL COST SHARE $65,440 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 7.6%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 15 Residual Nitrate Management					
15	384 Fertilizer Management	1985	96	96	96 acres	
15	384 Fertilizer Management	1987	89	89	89 acres	
15	384 Fertilizer Management	1988	89	89	89 acres	
	Subtotal BMP 15		**274**			
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1987	89	89	89 acres	
16	514 Pesticide Management	1988	89	89	89 acres	
16	514 Pesticide Management	1990	86	86	86 acres	
	Subtotal BMP 16		**264**			

NOTE: Some practice (mostly BMP 15 and BMP 16) were cost/shared in the year following the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 11 ACRES IN CRITICAL AREA 6,949 CRITICAL ACRES UNDER CONTRACT 6,629
TOTAL COST SHARE $126,980 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 14.8%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 1 Permanent Vegetative Cover On Critical Area					
1	382 Fencing	1986	893	143	957 ft	
1	512 Pasture & Hayland Planting	1989	1,236	32	32 acres	
1	550 Range Seeding	1987	1,719	34	34 acres	
	Subtotal BMP 1		**3,848**			
	BMP 5 Diversion System					
5	362 Diversion	1985	6,416	113	3,675 ft	2,883 cuyds
5	362 Diversion	1987	2,825	38	1,073 ft	4,800 cuyds
	Subtotal 362		**9,241**	**151**	**4,748 ft**	**7,683 cuyds**
	BMP 6 Grazing Land Protection Sys					
6	382 Fencing	1984	2,364	362	8,988 ft	

SUBBASIN 11 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 11 ACRES IN CRITICAL AREA 6,949 CRITICAL ACRES UNDER CONTRACT 6,629
TOTAL COST SHARE $126,980 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 14.8%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 6 Grazing Land Protection Sys					
6	614 Tanks	1984	754	1,906	3 tanks	
6	614 Tanks	1987	562	573	2 tanks	
	Subtotal 614		**1,316**	**2,479**	**5 tanks**	
6	642 Wells	1984	10,783	1,906	3 wells	
6	642 Wells	1985	4,300	1,376	2 wells	
6	642 Wells	1987	7,553	573	2 wells	
	Subtotal 642		**22,636**	**3,855**	**7 wells**	
	Subtotal BMP 6		**26,316**			
	BMP 7 Waterway System					
7	342 Critical Area Planting	1985	53	1	1 acre	
7	342 Critical Area Planting	1987	59	1	1 acre	
	Subtotal 342		**112**	**2**	**2 acres**	
7	412 Grassed Waterway or Outlet	1985	945	26	1 acre	
7	412 Grassed Waterway or Outlet	1987	405	1	1 acre	
	Subtotal 412		**1,350**	**27**	**2 acres**	
	Subtotal BMP 7		**1,462**			

SUBBASIN 11 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 11 — ACRES IN CRITICAL AREA 6,949 — CRITICAL ACRES UNDER CONTRACT 6,629
TOTAL COST SHARE $126,980 — PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 14.8%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 10 Stream Protection System					
10	382 Fencing	1985	920	64	2,079 ft	
10	580 Streambank Protection	1984	13,692	21	5,403 ft	
10	580 Streambank Protection	1985	3,118	5	1,133 ft	
10	580 Streambank Protection	1986	3,946	1	1,102.8 ft	
10	580 Streambank Protection	1989	1,633	2	1,030 ft	
	Subtotal 580		**22,389**	**29**	**8,668.8 ft**	
	Subtotal BMP 10		**23,309**			
	BMP 12 Sediment Retention, Erosion and/or Water Management Sys					
12	410 Grade Stabilization Struc	1991	14,692	80	1 unit	16,670 cuyds
12	638 Water & Sed Control Basin	1990	5,058	2	2 basins	373 cuyds
	Subtotal BMP 12		**19,750**			

SUBBASIN 11 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 11 ACRES IN CRITICAL AREA 6,949 CRITICAL ACRES UNDER CONTRACT 6,629
TOTAL COST SHARE $126,980 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 14.8%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 13 Improving an Irrigation and/or Water Management System					
13	430 Pipeline	1984	3,221	15	729 ft	
13	430 Pipeline	1991	6,614	89	1,789 ft	
			(2,409)		(589 ft pipeline)	
			(4,205)		(1,200 ft gated pipe)	
	Subtotal 430		**9,835**	**104**	**2,518 ft**	
13	447 Ir Sys Tailwater Recovery	1985	7,938	22	1 unit	
			(1,792)			1 pump
			(6,146)			1,733 cuyds
13	447 Ir Sys Tailwater Recovery	1991	6,043	89	1 unit	2.5 cuyds
						1 pump
						1,200'pwrline
	Subtotal 447		**13,981**	**111**	**1 units**	
	Subtotal BMP 13		**23,816**			
	BMP 14 Tree Planting					
14	382 Fencing	1986	5,625	25	16,681.5 ft	
14	612 Tree Planting	1986	5,886	37	27 acres	14,782 trees
						(4,968replants)
14	612 Tree Planting	1987	546	4	1 acre	2,000 replants
	Subtotal 612		**6,432**	**41**	**28 acres**	**16,782 trees**
						(6,968replants)
	Subtotal BMP 14		**12,057**			

SUBBASIN 11 continued

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 11 ACRES IN CRITICAL AREA 6,949 CRITICAL ACRES UNDER CONTRACT 6,629
TOTAL COST SHARE $126,980 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 14.8%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 15 Residual Nitrate Man					
15	384 Fertilizer Management	1984	450	450	450 acres	
15	384 Fertilizer Management	1985	483	483	483 acres	
15	384 Fertilizer Management	1986	606	606	606 acres	
15	384 Fertilizer Management	1987	730	730	730 acres	
15	384 Fertilizer Management	1988	655	655	655 acres	
15	384 Fertilizer Management	1989	454	454	454 acres	
15	384 Fertilizer Management	1990	274	274	274 acres	
	Subtotal BMP 15		**3,652**			
	BMP 16 Pesticide Management					
16	514 Pesticide Management	1984	450	450	450 acres	
16	514 Pesticide Management	1985	523	523	523 acres	
16	514 Pesticide Management	1986	895	895	895 acres	
16	514 Pesticide Management	1987	482	482	482 acres	
16	514 Pesticide Management	1988	655	655	655 acres	
16	514 Pesticide Management	1989	250	250	250 acres	
16	514 Pesticide Management	1990	274	274	274 acres	
	Subtotal BMP 16		**3,529**			

NOTE: Some Practices (mostly BMP 15 and BMP 16) were cost/shared in the year following the completion of the practice.

BMP IMPLEMENTATION: ACRES SERVED, UNITS APPLIED & COST SHARES BY SUBBASIN

SUBBASIN 12 ACRES IN CRITICAL AREA 7,Ø28 CRITICAL ACRES UNDER CONTRACT 6,848
TOTAL COST SHARE $11,Ø17 PERCENT OF TOTAL RCWP COST SHARE ASSISTANCE 1.3%

BMP	PRACTICE CODE/DESCRIPTION	YEAR	COST SHARE ($)	ACRES SERVED	UNITS APPLIED	MISC UNIT
	BMP 1 Permanent Vegetative Cover on Critical Area					
1	556 Planned Grazing System	1984	1,153	1,153	1,153 acres	
	BMP 6 Grazing Land Protection System					
6	382 Fencing	1984	475	18	2,475 ft	
6	614 Tanks	1984	1,Ø5Ø	1,398	3 tanks	
6	642 Wells	1984	6,886	1,398	3 wells	
6	642 Wells	1985	1,453	1,153	1 well	
	Subtotal 642		**8,339**	**2,551**	**4 wells**	
	Subtotal BMP 6		**9,864**			

Number and Proportion of Project Area Producers Implementing Each BMP:

The following series of charts illustrates the number of contracts implementing each BMP and addresses the number of practices implemented under each BMP.

See NOTE at the bottom of each page:

The "Number of Contracts" by code and the "% of Total Participating Contracts" by code do not relate to the "Total Number of Contracts" and "% of total Contracts by BMP subtotals because several contracts may have implemented various BMP practices within each BMP.

Subtotals for participation illustrate exactly how many producers participated within each BMP.

NUMBER AND PROPORTION OF CONTRACTS IMPLEMENTING EACH BMP

BMP	PRACTICE CODE/DESCRIPTION	NUMBER OF CONTRACTS	PERCENTAGE OF TOTAL CONTRACTS	NUMBER OF PRACTICES IMPLEMENTED	PERCENTAGE OF TOTAL PRACTICES IMPLEMENTED
	BMP 1 Permanent Vegetative Cover				
1	382 Fencing	3	3.5%	3	.4%
1	512 Pasture & Hayland Planting	3	3.5%	4	.6%
1	550 Range Seeding	5	5.9%	10	1.6%
1	556 Planned Grazing Sytstem	3	3.5%	3	.5%
	Subtotal BMP 1	**(11)**	**(12.9%)**	**20**	**3.1%**
	BMP 2 Animal Waste Management System				
2	312 Waste Management System	1	1.2%	1	.15%
2	313 Waste Storage Structure	1	1.2%	1	.15%
2	342 Critical Area Planting	1	1.2%	1	.15%
2	362 Diversion	1	1.2%	2	.3%
2	382 Fencing	1	1.2%	1	.15%
2	425 Waste Storage Pond	3	3.5%	5	.8%
	Subtotal BMP 2	**(3)**	**(3.5%)**	**11**	**1.7%**
	BMP 5 Diversion System				
5	362 Diversion	15	17.6%	20	3.1%
5	620 Underground Outlet	1	1.2%	1	.2%
	Subtotal BMP 5	**(16)**	**(18.8%)**	**21**	**3.3%**

NOTE: Number of Contracts by code and % of Total Participating Contracts by code do not relate to the total Number of Contracts and % of Total Participating Contracts by BMP subtotals.

NUMBER AND PROPORTION OF CONTRACTS IMPLEMENTING EACH BMP

BMP	PRACTICE CODE/DESCRIPTION	NUMBER OF CONTRACTS	PERCENTAGE OF TOTAL CONTRACTS	NUMBER OF PRACTICES IMPLEMENTED	PERCENTAGE OF TOTAL PRACTICES IMPLEMENTED
	BMP 6 Grazing Land Protection System				
6	378 Pond	1	1.2%	1	.2%
6	382 Fencing	11	12.9%	16	2.5%
6	516 Pipeline	3	3.5%	4	.6%
6	614 Tanks	13	15.3%	22	3.4%
6	642 Wells	12	14.1%	26	4.0%
	Subtotal	**(17)**	**(20.0%)**	**69**	**10.7%**
	BMP 7 Waterway System				
7	342 Critical Area Planting	4	4.7%	5	.8%
7	412 Grassed Waterway or Outlet	4	4.7%	5	.8%
	Subtotal	**(4)**	**(4.7%)**	**10**	**1.6%**
	BMP 9 Conservation Tillage System				
9	329 Conservation Tillage System	2	2.3%	2	.3%
	BMP 10 Stream Protection System				
10	322 Channel Vegetation	1	1.2%	2	.3%
10	382 Fencing	4	4.7%	5	.8%
10	580 Streambank Protection	15	17.6%	48	7.5%
	Subtotal	**(18)**	**(21.1%)**	**55**	**8.6%**

NOTE: Number of Contracts by Code and % of Total Participating Contracts by code do not relate to the total Number of Contracts and % of Total Participating Contracts by BMP subtotals.

4
NUMBER AND PROPORTION OF CONTRACTS IMPLEMENTING EACH BMP

BMP	PRACTICE CODE/DESCRIPTION	NUMBER OF CONTRACTS	PERCENTAGE OF TOTAL CONTRACTS	NUMBER OF PRACTICES IMPLEMENTED	PERCENTAGE OF TOTAL PRACTICES IMPLEMENTED
	BMP 11 Permanent Vegetative Cover On Critical Area				
11	342 Critical Area Planting	17	20.0%	23	3.6%
11	382 Fencing	4	4.7%	4	.6%
11	484 Mulching	4	4.7%	4	.6%
	Subtotal	**(18)**	**(21.1%)**	**31**	**4.8%**
	BMP 12 Sediment Retention, Erosion or Water Control Structures				
12	342 Critical Area Planting	1	1.2%	2	.3%
12	350 Sediment Basin	2	2.4%	2	.3%
12	382 Fencing	1	1.2%	1	.2%
12	410 Grade Stabilization Structure	6	7.1%	9	1.4%
12	587 Structure for Water Control	3	3.5%	4	.6%
12	638 Water & Sediment Control Basin	5	5.9%	8	1.2%
	Subtotal	**(16)**	**(18.8%)**	**26**	**4.1%**
	BMP 13 Improving an Irrigation and/or Water Management System				
13	430 Pipeline	20	23.5%	24	3.7%
13	447 Ir Sys Tailwater Recovery	21	24.7%	39	6.1%
13	449 Irrigation Water Management	2	2.4%	3	.5%
13	587 Structure for Water Control	6	7.1%	20	3.1%
	Subtotal	**(24)**	**(28.2%)**	**86**	**13.4%**

NOTE: Number of Contracts by Code and % of Total Participation Contracts by Code do not relate to the total Number of Contracts and % of Total Participating Contracts by BMP subtotals.

NUMBER AND PROPORTION OF CONTRACTS IMPLEMENTING EACH BMP

BMP	PRACTICE CODE/DESCRIPTION	NUMBER OF CONTRACTS	PERCENTAGE OF TOTAL CONTRACTS	NUMBER OF PRACTICES IMPLEMENTED	PERCENTAGE OF TOTAL PRACTICES IMPLEMENTED
	BMP 14 Tree Planting				
14	382 Fencing	8	9.4%	10	1.6%
14	441 Irrigation Drip System	1	1.2%	1	.2%
14	612 Tree Planting	10	11.8%	25	3.9%
	Subtotal	**(10)**	**(11.8%)**	**36**	**5.6%**
	BMP 15 Residual Nitrate Management				
15	384 Fertilizer Management	48	56.5%	137	21.3%
	BMP 16 Pesticide Management				
16	514 Pesticide Management	49	57.6%	138	21.5%

RCWP Program Totals **642 Cost/Share Practices Implemented on 85 Contracts**

NOTE: Number of Contracts by Code and % of Total Participating Contracts by Code do not relate to the total Number of Contracts and % of Total Participating Contracts by BMP subtotals.

Discontinued BMPs under RCWP

Although none of the approved BMPs were ever officially discontinued some were not widely used.

BMP 4 - Terrace System was not used at all. BMP 4 was not generally applicable as the majority of the cropland in the area was leveled in preparation for gravity irrigation.

BMP 9 - Conservation Tillage System, was not implemented to the degree originally anticipated. BMP 9 was only used twice and was then discontinued. Conservation tillage is defined as any tillage practice that leaves 30% residue on the field after planting. Most of the farmers in the watershed employ some type of reduced tillage method on their farms. It was therefore decided that with so much volunteer participation, the cost-share incentive was not necessary.

Changes in BMP Emphasis:

BMP emphasis was originally centered around BMP 2-Animal Waste Management Systems, BMP 12-Sediment Retention, Erosion or Water Control Structures, BMP 10-Stream Protection System and BMP 15, 16-Fertilizer and Pesticide Management.

Emphasis on BMP 2 was eventually abandoned when feedlots were unable to receive cost-share benefits due to their point source identification. When the large sediment control structures were unable to be funded, emphasis on BMP 12 was reduced.

BMP emphasis evolved to center around BMP 13-Improving an Irrigation and/or Water Management System, BMP 6
-Grazing Land Protection System, and BMP 5-Diversion System. BMP 15 and 16-Fertilizer and Pesticide Management remained high priority objectives throughout the project.

Contract Modifications and Violations

Total Number of Contracts: A total of 86 contracts were written on farms within the critical area from 1981-1986. One contract was cancelled during this period when a producer moved out of the area. The land was placed into another RCWP contract by the new owner who had adjacent land and was a participant in RCWP.

Contract Modifications: Modifications of items originally included in the water quality plan for each contract was ongoing. Modifications were written for the following reasons:

*when land was added to the critical area

*when additional BMP practices were approved

*in order to delete BMPs when it was determined they were no longer needed in the water quality plan

*when an owner or operator lost control of critical acres

*when an owner or operator gained control of critical acres

*as priorities changed and emphasis was placed on items not originally included in water quality plans

(such as BMP 13-Improving an Irrigation and/or Water Management System, especially Tailwater Recovery)

*To provide funds for cost-share pooling agreement:

*when contracts had to be extended to allow additional time for the proper installation of practices

*when especially successful practices already implemented were deemed applicable to other areas of the farm or ranch

Modifications were time consuming for SCS technicians. Often items had to be designed or redesigned and the scheduling of any additional practices was extremely difficult.

Contract Violations: There were no contract violations. SCS worked closely with local area producers. Most practice sites were visited frequently throughout the installation and maintenance periods. This helped prevent any misunderstandings by producers that could have led to potential violations.

However, a claim was filed against the Long Pine RCWP when 85 cedar trees on private property were cut down and utilized for stream protection measures. Members of the LCC were demonstrating revetment construction to a group of boy scouts and girl scouts. The trees were inadvertently cut down on property that was not under contract in the RCWP.

Impacts of Other Federal Programs

The 1985 Farm Bill (Food Security Act of 1985) had a tremendous impact on RCWP.

Nebraska is a major grain and livestock producing state. In 1985 the farm economy was severely depressed. Several consecutive years of falling commodity prices had collapsed the local economy. Agricultural bankruptcies were at an all time high and many local businesses had closed their doors. Many agricultural lending institutions throughout the state had also been forced out of business.

The 1985 Farm Bill provided immediate economic relief. Farm subsidy programs helped prevent the agricultural economy from further decline. Farm subsidies were not new. However the programs had a different twist. Programs were designed to subsidize farmers while requiring them to comply with conservation measures that would control erosion and provide protection to wetland areas.

In order to receive subsidy payments, producers were required to have a conservation plan written on their farm. This plan, written by SCS technicians, complied with the sodbuster and swampbuster provisions written into the 1985 Farm Bill.

The SCS had to make Highly Erodible Land (HEL) or non-HEL determinations for every cropland field in the area. These determinations were made by analyzing soil survey maps. The Ainsworth SCS office, implementing RCWP, served a three county area. HEL determinations had to be made for 94,000 acres in Brown County, 61,000 acres in Keya Paha County, and 85,000 acres in Rock County.

Another provision of the 1985 Farm Bill was the Conservation Reserve Program (CRP). In the CRP program, the USDA rents land (bid into the program) for 10 years (from the producer) and cost-shares on the expenses involved in establishing a grass cover on the land. From 1986 through 1990, 21,289.3 acres were accepted into the CRP in Rock County; 15,420.6 acres were accepted into the CRP in Brown County and 3,855.2 acres were accepted into the CRP program in Keya Paha County. This does not include land bid into the program that was not accepted. This program required a tremendous amount of SCS technicians time in determining eligibilities, planning and scheduling CRP cost-share practices, certification of completed practices and annual onsite status reviews.

The SCS was overwhelmed. USDA programs monopolized technicians time during the peak years of RCWP BMP implementation. During this period, the SCS staff was reduced from six full-time and one part-time staff to two full-time staff. BMP practices scheduled for implementation had to be put off and incorporated into the workload schedule. The RCWP program never really recovered from the backlog of implementation. Some practices were completed years after they had been scheduled. Timely implementation was the single largest problem during this period.

Impacts of State and Local Programs and Regulations:

Impacts of state and local program regulations were not as severe as at the federal level. (For specific contributions by each agency see Chapter 5 - Institutional Relationships). Impacts centered around:

*design approval procedures; these time consuming procedures were discussed under BMP 2 - Animal Waste Management Systems -- implementation difficulties, Chapter 3;

*404 permits were required from the U.S. Army Corps of Engineers before some practices could be installed. In one case, the Army Corps of Engineers permit prohibited the rechanneling of one of the creeks to avoid a seriously eroding streambank. As a consequence, other more feasible solutions were discovered;

*DEC determinations of specific feedlots in the area as point sources of pollution and thus under a schedule for compliance with EPA regulations;

*There were many beneficial effects of other state and local cost-share programs and grants on the program.

Technical Assistance:

Overall Assistance: Technical assistance for BMP implementation was provided by the SCS and CES for cost-share and noncost-share items. Other agencies provided technical assistance for many of the point source pollution control measures that were funded elsewhere, such as Critical Area Treatment (CAT) for roadsides etc.

Types and Amounts of Assistance Provided to Producers Implementing Each BMP

Technical expertise was needed in varying degrees for all practices. BMP systems were employed in which various practices were designed to work together to achieve a specific goal. Practices involving survey and design took the greatest amount of time. Sometimes designs had to be modified or redesigned if the site location was changed. The SCS spent a tremendous amount of time with each producer in applying each practice. Practices had to be inspected following completion and maintained.

SCS worked with the B-K-R Public Power to develop technical standards criteria on power lines for the Technical Guide for cost-sharing under BMP 13. SCS developed standards for the Tech Guide for BMP 10-Stream Protection System.

Lessons Learned

*An overall understanding of the project is needed in order to design BMP systems

*An overall understanding of each farm operation is needed in order to design BMP systems

*Practices involving survey and design are time consuming

*An adequate amount of technical staff devoted solely to RCWP is necessary.

*The SCS will spend more time with each producer than any other agency. This contact is important in developing a producer understanding of BMP systems and their responsibility for maintenance.

*Technical innovations initiated in each RCWP project should be shared.

Technical Personnel Evaluation of RCWP

The SCS and CES personnel who worked with RCWP from 1981-1991 have made observations about the lessons learned in implementing an extensive experimental project such as RCWP.
Among them are:

*The need for a project coordinator; a project planner, (with incentives to GS-11 to encourage the planner to stay with the project); and a project engineer.

*A certain amount of time is needed at the beginning of a project of this length and magnitude to prepare a comprehensive plan with clear objectives and goals, before Water Quality Plans can be written or any BMP implementation takes place.

*More authority given to the TAC Committee.
*More structured LCC meetings with designated voting members and quorum requirements. Special interest groups participation limited.

*Once goals are established they should be followed.

*The SCC and area offices need to be totally committed to the project and provide leadership, support and assistance to the LCC and local offices.

*Orientation needs to take place for SCS planners and engineers coming into the project.

* The LCC should have more decision making power.

*There is a thin line between point and NPS pollution. Projects should address both.

*There needs to be more acceptance of experimental practices. A lot can be learned from them even if they do not achieve specific goals.

*Water Quality programs have been written into the 1990 Farm Bill. Each RCWP project provides the state with a valuable resource. Each project has accumulated a vast amount of knowledge about BMPs and their relationship to point and NPS pollution. This information should be exploited. There were only 21 RCWP projects in the United States. These watersheds should become educational training centers for technical personnel in all agencies.

CHAPTER 4—INFORMATION AND EDUCATION

Findings and Recommendations

*CES is a valuable resource base.

*I&E is effective when reponsibility is given to one agency.

*I&E goes hand in hand with CES objectives.

*When economic advantages of BMPs are stressed, practices are widely adopted.

*Interest can be generated throughout the community and take off on its own such as with the IPM Assn. and Demonstration farm.

*Field demonstrations are a powerful tool to use to communicate with producers.

*Technical funds need to be allocated for I&E activities.

CES—Responsibilities, Strategies, Results

I&E is an important part of any project. The degree of RCWP participation and acceptance is directly related to information and education activities. The I&E Committee, chaired by CES, was given the full responsiblity for all I&E activity in the Long Pine RCWP. This was an ideal situation as CES activities go hand in hand with agricultural conservation practices. The CES operates through the University system and is involved in developing innovative approaches to agricultural production. The CES is also responsible for distributing this information throughout rural communities.

I&E responsibilities for RCWP are extensive and cannot be absorbed by the local CES staff. Technical assistance funds must be allocated to CES in order to provide for staff salary and program development solely devoted to RCWP activities. Funding is needed for the first six years of the project, or until most of the practices have been installed.

In order to be effective, I&E should be conducted in three phases: initial, on-going and final. The initial phase is the awareness phase. This phase occurs early in the project and should be designed to generate enthusiasm, acceptance, and interest in the project. The on-going phase strengthens the initial phase and includes expansion and development of ideas and practices outside of the critical area. In the final evaluation phase, education is intended to expand and continue into new project areas. Results and lessons learned need to be evaluated and shared. The intital and on-going phases will generate the heaviest workload. A great deal of resources will be required to carry out the project I&E objectives. The final evaluation phase occurs as the project winds down.

In an experimental project such as RCWP, an effective I&E program cannot begin until the I&E committee acclimates itself to the project. I&E will need a period of time to devote to research, education, planning, and working with the LCC in order to have a clear understanding of the project and its direction. Personnel from ASCS, SCS, and CES along with other agencies will have direct personal contact with producers. There must be a general continuity of information given by all persons involved in RCWP.

The I&E Committee was comprised of LCC members representing ASCS, CES, SCS and MNNRD. The I&E Committee established objectives, defined and prioritized the audience it intended to address, defined the message objectives, and outlined educational methods intended for use.

The objectives were:

*To plan, prepare and present workshops, demonstrations and other suitable presentations in accordance with RCWP objectives using existing programs as a base.

*To coordinate project-related information flow into the project area by involved federal, state and local agencies.

*Conduct demonstrations and educational programs for landowners toward adoption of BMPs that will reduce siltation and minimize the presence of fertilizer pesticide and animal waste in Long Pine Creek and its tributaries.

*To evaluate landowners' attitudes and effectiveness of the I&E plan and to adjust procedures as the need arises to effectively complete the I&E project.

Objectives were directed toward an audience of:

*landowners and farm operators in the critical project areas

*Area fertilizer and chemical dealers

*the general public within the project area

*Schools and youth groups

*the general public outside the project area

The message content was designed to provide:

*a complete understanding of the program by the landowner and operator

*a thorough knowledge of all BMPs by landowners and operators

*a complete understanding of the contract and what the landowner's responsibilities are

*awareness of cost-saving factors of fertilizing based on soil tests; integrated pest management use of pesticides and reduced tillage methods

Educational methods to be employed included:

*Printed materials: a variety of materials such as

periodic newsletters, illustrated brochures, farm letters and fact sheets

*Mass media: mass media coverage in the project area included newspapers, radio, television, and farm magazines

*Individual contact: when necessary to explain the program provisions, and to develop plans for handling critical and long-term agreements.

*Public meetings: to help inform local people inside and outside of the project area of the basic concepts of the RCWP project.

*Tours: short tours to demonstrate the effects of BMPs in action

*Demonstration: field demonstrations to feature and show benefits of BMPs; i.e. tillage, proper fertilizer use, range management, etc.

I&E Priority: Emphasis was placed on educating producers in the areas of irrigation scheduling, conservation tillage, fertilizer management involving deep soil testing and pesticide management using Integrated Pesticide Management (IPM) techniques.

The Audience Setting: North central Nebraska is an agricultural area with a small population. Citizens are emotionally attached to the land and their heritage. Every community wants to improve itself and leave something better for the next generation. Farmers and ranchers throughout the area are familiar with one another and are knowledgeable about each other's operation. A producer involved in a project or initiating a practice communicates this knowledge to others. This atmosphere was ideal for fostering acceptance of the RCWP project and BMPs.

As producers became involved with the RCWP and began implementing practices on their land, interest and involvement was generated throughout the community. During difficult economic times in the early 1980s, many people were interested, but economically unable, to participate in the RCWP. As soon as the economic advantages of BMP 15 and 16 became apparent, adoption of these practices snowballed. Producers throughout the watershed began incorporating fertilizer and pesticide management on their farms. The response was overwhelming. Today, a significant reduction in pesticide and fertilizer use has been achieved throughout the watershed. This is entirely attributed to the efforts of the CES in conjunction with the I&E activities.

I&E Application: Using a combination of meetings, newsletters, media coverage, and demonstrations, I&E activities began in 1981. During the first year of RCWP (fiscal year 1981-1982), six educational meetings were held addressing RCWP awareness, fertilizer management, insect scouting, and conservation tillage. A 4,000 lb. capacity weigh wagon was leased to provide yield data to the producers participating in the fertilizer and pesticide management programs. A 26 minute video tape, outlining the needs and benefits of the project was completed and broadcast over Nebraska Public Television. The RCWP quarterly newsletter was initiated. Field demonstrations became an important educational tool.

The RCWP quarterly newsletter, entitled "Long Pine Rural Clean Water Program Newsletter", was distributed throughout the watershed and provided participants and nonparticipants with current information on all RCWP activities, (see RCWP Newsletter in Appendix).

Three video tapes were made, two of which appeared on Nebraska Public Television (NPTV). "Death of a Troutstream," was aired October, 1980 and "Long Pine Creek-Reclaiming A Resource" was aired in October

and November of 1981 on NPTV. The third video, "Long Pine Creek - A Stream Reborn", has been widely used for training and educational purposes.

Public Involvement: In 1983 the Integrated Pesticide Management (IPM) association was established by producers working with Paul Koerner, extension agent in the Brown County area. The IPM association began distributing a newsletter providing producers with timely information on insect identification, scouting procedures, weather conditions, and pesticide application methods.

The IPM concept focuses on a minimum use of pesticides for an optimum effect. The widespread use of pesticides in the early 1960s had increased production costs, reduced beneficial insect populations, polluted land and waters and led to insecticide resistance by some insects. In IPM, the need for pesticide application is determined by field examinations for insects.

IPM is a total pest control program, combining chemical controls, crop rotation, hybrid selection, and other methods, in an attempt to utilize natural controls in an effort to keep crop pests below economically damaging levels. Each field signed up for the program is scouted weekly for signs of insect infiltration or pest damage. Field scouts are trained by CES. Scouts are taught identification of major insects, insect biology, population sampling techniques and the use of economic thresholds to determine the need for treatment.

Most of the scouting is done in June, July and August. Information obtained in the scouting reports is used to make control decisions. Whenever insect populations reach an economic threshold level, the point at which the yield loss will outweigh the cost of chemical application, producers generally decide to apply pesticides. Before IPM, producers applied pesticides as an insurance against insect damage. These applications were generally not very effective as many damaging insects are effectively treated only during a brief period of a few days to a week. The elimination of a single application decreased production costs. Farmers have widely adopted IPM practices throughout the watershed.

In 1990, one-third of the irrigated acres in Brown County were scouted through IPM. Approximately 50% of the fields did not require a rootworm insecticide at planting as beetle numbers in 1989 were not high enough to cause economic damage to the 1990 corn crop. Insect population did not reach the economic threshold for European Corn Borer (lst and 2nd generation) so treatment was not necessary. Western Bean Cutworms, however, were found in unusually large numbers and had to be treated to prevent economic losses on most acres. (See IPM newsletter in Appendix).

Demonstration Farm: Field demonstrations were a valuable tool for I&E purposes. Fertilizer, pesticide, and tillage methods were employed on individual farms to demonstrate the effectiveness of various practices. Demonstration tours were given for the public to view results. These were well attended and were very effective.

The CES wanted to perform a variety of long term experiments. It was difficult to plan these experiments around the producer's planting operation in conjunction with farm set-aside programs, etc. In 1985, the Brown County Extension Service began a demonstration farm. The farm was established to study the effectiveness of BMPs such as fertilizer, pesticide and water management, and conservation tillage, and to conduct a variety of other long term experiments, such as a four year liming study.

Data collected from the demonstration farm was used to compare tillage methods, varietal yield performance, fertilizer use and cost, groundwater nitrate levels, herbicide and insecticide use and soil test results (before and after cropping).

RCWP funds were used to pay half of the rent of the farm from 1985-1987. The sale of crops produced on the farm paid for other expenses incurred. All farm work was performed by the extension staff. Local businesses ran the irrigation systems, donated equipment for fertilizer and herbicide application, and harvested the crops. Irrigation, fertilizer and pesticide methods followed University of Nebraska-Lincoln (UNL) recommendations. The farm was monitored for insects by IPM field scouts at a cost of $1 per acre. Total contributions including seed, fertilizer, chemicals, machinery, and other materials since 1985 is over $50,000.

The demonstration farm generated a lot of interest and provided an excellent opportunity to present agricultural ideas and experiments and to demonstrate techniques that preserve and enhance soil and water quality. Experiments have included corn and soybean variety test plots, grass seeding trials, shrub plantings for erosion control under center pivots, chemical weed control on sandy soil, IPM method of insect control, soil lab comparison studies, liming and phosphorous studies, no-till planting on soybean stubble, techniques for ground cover following potato crop harvest, alternative crop study (lupins, onions, canola), residual nitrate study, and irrigation scheduling.

The information gathered was disseminated through tours, presentations, meetings, publications, newsletters, articles, radio programming and personal contact.
The demonstration farm has continued since its inception in 1985.

Deep soil sampling, originally part of BMP 15, has become a valuable aid in determining soil nutrient needs. Soils are tested for nutrient content and fertilizer applications are adjusted accordingly. In 1990, a residual nitrate test was undertaken by Bud Stolzenburg, Steve Pritchard, Jack Robinson and Ralph Kulm of the CES. The experiment's objective was to minimize the potential for ground water contamination by reducing fertilizer applications. Deep soil samples were taken on 65 farms in a 13 county area in north central Nebraska. Test results indicated that approximately 43% of the fields tested required reduced fertilizer applications. Based on the soil tests, one producer in the watershed reduced his application from 180 lbs. to 23 lbs. of N per acre and achieved a 179 bu. per acre yield. This was compared with the previous year's application of 180 lbs. of N per acre resulting in a 176 bu. per acre yield.

The CES has conducted hundreds of weigh wagon test strips to provide yield data for variety and fertility tests. In 1983, average fertilizer costs on participating farms was $62 an acre (with an average of 206 lbs. of N per acre). By 1986 the average N had been reduced to 177 lbs. per acre, resulting in an average cost of $47 an acre. Dollars saved by producers in the are is estimated at $200,000 annually. The decrease in production costs for producers has created a widespread acceptance of these practices.

The following is a summary of the major accomplishments of the demonstration farm from 1985-1990.

*Liming Study, Soil Test Lab Comparison, Phosphorous Rate and Placement Study; Dr. Gary Hergert

*Spent Acid Study, Phosphorus Rate & Placement Study; Dr. Don Sanders

*Reduced Tillage Demonstration, Dr. Norm Klocke

*Cool and Warm Season Grass Selection Trials - both dryland and irrigated, Dr. Ken Vogel

*Herbicide Trials on Cool Seasons Grasses, Dr. Robert Masters

*Herbicide on Alfalfa Establishment Trial, Dr. Bruce Anderson

*Crambe and Milkweed Evaluation Trials, Dr. Lenis Nelson

*Potato Fertilizer Trials, Dr. Robert O'Keefe

See "Demonstration Farm Results" in Appendix for the results of two liming studies; a Phosphorus Rate and Method Experiment; Soil Test Lab Comparison Experiment and a Residual Nitrate Demonstration Project.

List of Published General Material

Long Pine Rural Clean Water Program newsletter, Volume 1 1982-1983; Volume 2, 1983-1984; Volume 3, 1984-1986; Volume 4, 1986-1987; Volume 5, 1987-1988; Volume 6, 1989; Volume 7, 1989-1990.

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Alternative Tillage Methods for Sandbur and Erosion Control in Sandy Soils 1982-83. R. Todd, N.L. Klocke, D. Bauer, E.C. Dickey.

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BKR Extension.

Proceedings. Dennis Bauer. "Minimum Tillage for Crop Rotations on Sandy Soil." Crop Focus-86.

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Manuscript 1988. "Comparison of Sand Bluestem and Prairie Sandreed Establishment in Nebraska". Robert A. Masters, Kenneth P. Vogel, Patrick E. Reece, and Dennis Bauer.

Soil Science Research Report 1988. Progress Report on the B-K-R Demonstration Farm: Gary W. Hergert, Dennis Bauer and Don Sander, pp. 72-80.

Applied Engineering in Agriculture. "Surface Cover from Corn Residue on Sandy Soils". R.Todd, N.L. Klocke, E.C. Dickey, D. Bauer. (Vol. 4, No. 3, pp. 234-236).

Cranbe Production in Nebraska. J.L. Bushnell, L. Nelson, R. Moomaw, R. Elmore, R. Mills, D. Bauer and R. Stougaard. 1988. Agron. Abstr. Vol. 30, pg. 123.

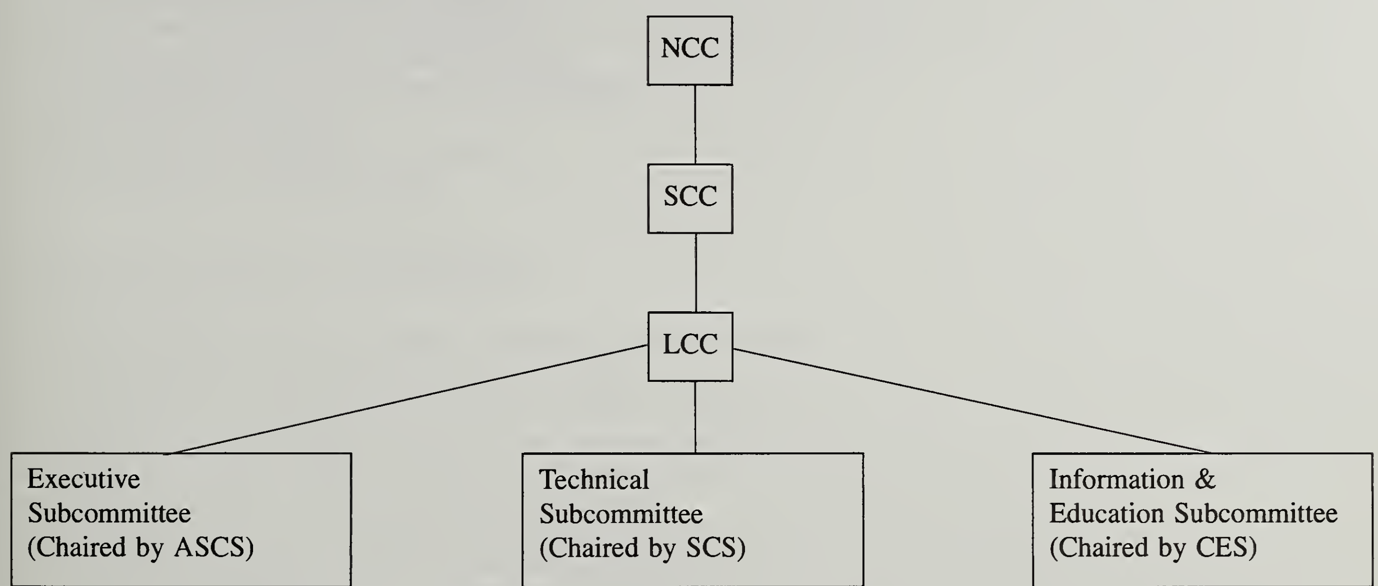
Nebraska Potato Focus. December, 1990. A presentation was made at Scottsbluff on the results of the Potato Fertility Trial at the demonstration farm. Over 150 persons attended.

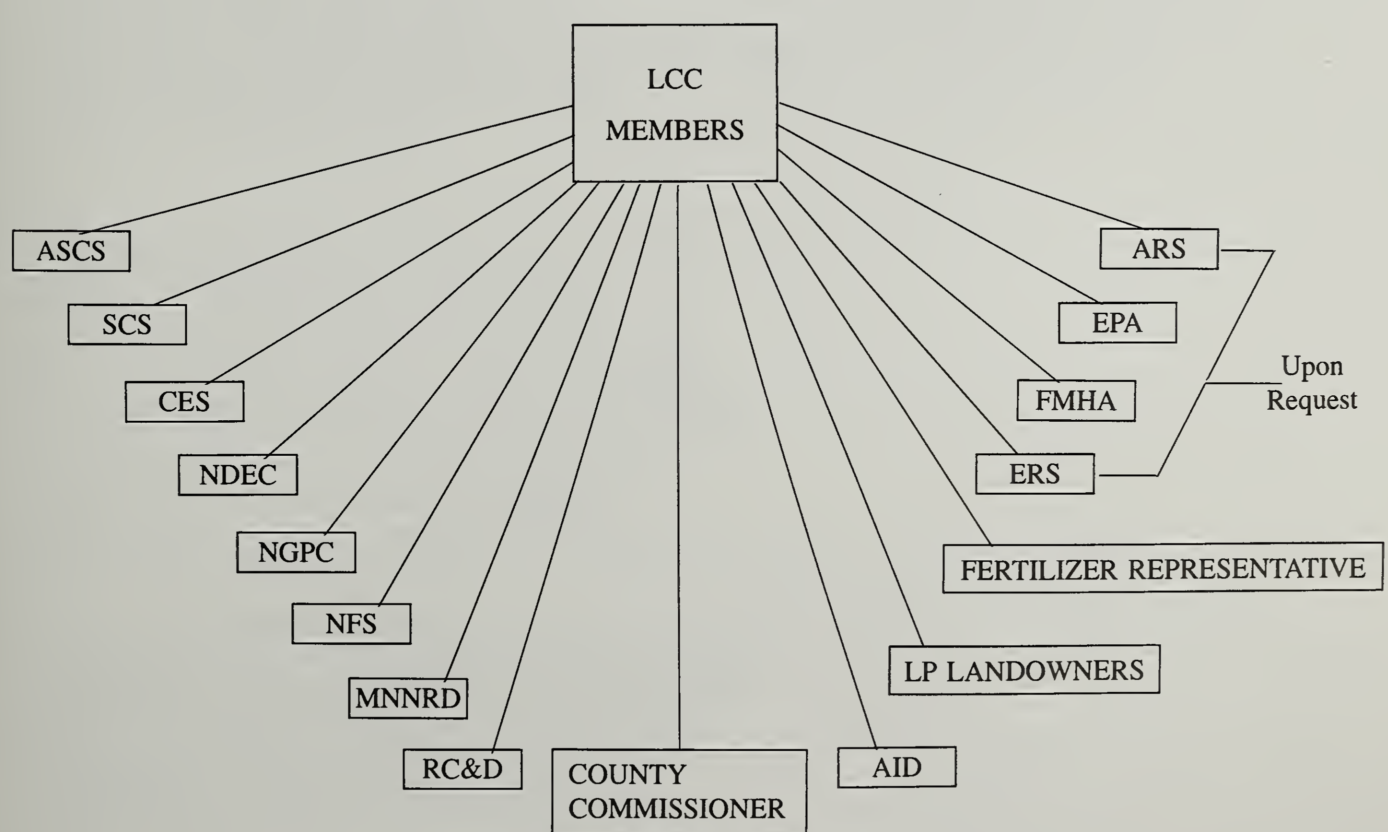
Variety and Fertilizer Test in Nebraska. Dennis Bauer, Robert O'Keefe. Nebraska Potato Focus, 1990, pp. 30-35.

Soil Test Lab Comparison Exp. on the B-K-R Demonstration Farm. Gary Hergert, Dennis Bauer and Bud Stolzenburg. Soil Science Research Report 1990. pp. 79-84.

CHAPTER 5—INSTITUTIONAL RELATIONSHIPS

Long Pine Creek RCWP Management Structure





CHAPTER 5—INSTITUTIONAL RELATIONSHIPS AND ECONOMICS

Findings and Recommendations

Institutional Relationships and Economic findings and recommendations fall into seven main categories:

1. Institutional Relationship Highlights
2. The need for a Project Coordinator;
3. SCS and ASCS-Additional Personnel;
4. Establishment of a point source committee;
5. SCS/LCC Interaction;
6. Economic Evaluation - Data Log;
7. Return of Cost-Share Funds

1. Institutional Relationship Highlights:

*State agencies such as NGPC, MNNRD and RC&D were brought into the project and made significant contributions to the RCWP's success. NGPC provided technical and cost-share assistance for many stream-bank stabilization practices. RC&D was instrumental in the installation of six roadside Critical Area Treatments (CATs) which addressed point source pollution problems. The MNNRD installed two drop structures (gabions) at the headwaters to address the headcutting problem there.

*Water Quality Monitoring involved collecting hundreds of samples and sending them in for analysis. The logistics of the watershed presented problems. The MNNRD, SCS, and CES worked closely with the NDEC in collecting samples throughout the project period.

2. **A Project Coordinator** is of utmost importance in a project of this size and length. Every agency involved in RCWP has major responsibilities elsewhere. Throughout the decade of RCWP activity, there were many years when the efforts of all agencies were drawn toward other programs which were assigned immediate priority. The RCWP was often placed on the back burner. A project coordinator is necessary in order to move the project ahead during these difficult times. A general continuity to the program must be focused on and maintained.

The project coordinator should have excellent communication and organizational skills. An atmosphere of collaboration and teamwork must be cultivated within the LCC. The project coordinator must be able to take initiative, do research, develop good public relations, write proposals, adjust priorities and goals as the project develops and keep the LCC focused. There are

many differing opinions regarding priorities and approaches to specific problems. LCC meetings should be structured using agendas, voting and quorum requirements and must follow Roberts Rules of Order.

3. **SCS and ASCS need full-time personnel devoted to the** RCWP. SCS needs to provide a project planner and a project engineer until the majority of practices have been completed. ASCS needs to provide a full-time program assistant to RCWP for at least as long as the contracting is underway.

4. **Point Source Committee:** In addition to the Executive, I&E and Technical subcommittees, the LCC needs to create a Point Source Committee. This committee would devote itself to point source problems. The LCC spent much time focused on point source problems which it felt were impossible to separate from the NPS pollution problems. All persons working on the project were frustrated throughout the project period with point source pollution problems.

5. **SCC/LCC Relationships.** The SCC and LCC need to interact to a greater degree for mutual understanding. The SCC should be in on some of the hands-on negotiations and problem solving at the local level.

6. A Data Log needs to be established to record economic and other pertinent data throughout the life of the project. Procedures are defined in Chapter 3 - Implementation Results; F&Rs, 5. Documentation of Technical and Cost-Share Data.

7. In 1990 the LCC returned RCWP cost-share funds to Washington that they felt would not be needed. Within a year additional funds were necessary to complete RCWP practices. Although the funds were obtained, it is generally felt that funds should not be returned until all of the practices have been completed. Many technicians feel that some additional funds should be kept on hand for maintenance of structures and other practices.

Institutional Arrangements

The ASCS was given full responsibility for developing and administering RCWP nationally. The National Administrator of ASCS chairs the NCC, the State Administrator of ASCS chairs the SCC and the County Administrative Committee (COC) chairs the LCC.

The national administrator of SCS, ES, EPA, FS, FmHA, ERS and ASCS serve on the NCC. According to the RCWP manual, the NCC's responsibilities are to:

*Help ASCS develop regulations and procedures.

*Recommend project applications for ASCS approval.

*Advise the Secretary on the maximum Federal contribution to the total cost of the project.

*Help coordinate individual agency programs with RCWP.

*Make recommendations on the technical aspects of the program, including the agencies and others that provide technical assistance.

*Recommend project areas and criteria for comprehensive joint USDA and EPA water quality monitoring evaluation and analysis.

*Annually review the Plan of Work.

*Approve needed changes in the projects.

*Annually review the program progress in each project. Periodically advise the Secretary, the Under Secretary for International Affairs and Commodity Programs, and Assistant Secretary for Natural Resources and the Environment on program and policy issues.

The SCC was comprised of administrators of each agency represented on the NCC. The SCC responsibilities are to:

*Submit recommendations for approval of project applications to STC for forwarding to NCC through administrator, ASCS.

*Ensure coordination of activities at the project level by recommending to STC the composition and responsibilities of LCC.

*Provide oversight for the RCWP in the state and assist in the monitoring and evaluation of selected project areas, including coordination with the LCC.

*Develop procedures for coordination between the RCWP and other water quality programs at the local level.

*Review and forward the Plan of Work, annual progress report, and changes recommended by LCC to STC.

*Assist in project monitoring and evaluation.

The LCC was comprised of local administrators of agencies represented on the NCC and SCC, as well as representatives of other state and local agencies. The LCC responsibilities are to help the COC to:

*Ensure that a process exists and actions are taken to carry out any approved project.

*Ensure an adequate level of public participation in carrying out the project.

*Provide project coordination, including developing the Plan of Work, for carrying out the approved project using various USDA agencies, local agencies and interested groups.

(1) Enlist other agencies and local groups to use their resources to carry out projects.

(2) Conduct I&E about the projects.

(3) Develop criteria with SCC for COC and SCS to use to establish priorities for individual applications for developing water quality plans.

(4) Help develop an adequate plan for project monitoring and evaluation.

*Consult with SCC for coordination with USDA State officials, State water quality officials, and EPA regional representatives to develop criteria for project Plan of Work and project coordination.

*Review the project Plan of Work annually.

*Recommend changes in the approved project to COC.

*Assist in project monitoring and evaluation, as appropriate.

The LCC formed three subcommittees. They are the Executive (chaired by ASCS), the Technical Action (TAC) (chaired by SCS), and the Information & Education (I&E) (chaired by CES). Each committee was assigned responsibilities.

The Executive subcommittee responsibilities are to: Provide administrative support to the RCWP; help LCC coordinate the Annual Plan of Work; provide support to the TAC and I&E subcommittees; coordinate BMP development; accumulate average cost data to support cost-share payments; perform other essential duties as assigned by LCC; act on administrative matters when the COC is absent.

The TAC subcommittee responsibilities are to: Develop the technical assistance, monitoring and evaluation portion of the Annual Plan of Work; develop the project strategy portion of the Annual Plan of Work; help the Executive subcommittee develop BMPs; develop a technical assistance priority system for treating water quality problem areas.

The I&E subcommittee responsibilities are to: Develop the RCWP's I&E program; develop the I&E portion of the Annual Plan of Work; coordinate the I&E plan with the Executive and TAC subcommittees; conduct field tours and demonstration projects; secure adequate media coverage; perform other I&E duties that the LCC assigns.

LCC-SCC Coordination

The LCC had complete responsibility for project development. The LCC consulted with the SCC on many occasions in regard to RCWP eligibilities, special project activities etc. Members of the LCC met with the SCC occasionally to review the Annual Report and the Plan of Work. The relationship was intermittent. Communication was hampered by distance. The SCC was located in Lincoln, Nebraska, and the LCC in north central Nebraska, 280 miles apart.

LCC members felt the SCC did not have enough hands-on knowledge of the area to understand or support many of the ideas and projects that were recommended by the LCC. It would have been extremely beneficial for the SCC and the LCC to interact to a greater degree. The SCC needs to be in more of the negotiations, discussions and problem solving that is an on-going procedure in RCWP. It would have been very effective if the LCC had their regular meeting with the SCC present and involved on a quarterly basis. If this is not possible, one SCC member could attend each LCC meeting. In this way, members of the SCC and LCC would have a greater understanding of the program, it's development and application.

It has been suggested that the SCC create a Technical Committee composed of persons from several agencies who would be able to devote a significant amount of time to the project, specifically the technical aspects of innovative or new practices that would be recommended by the LCC.

BMP Maintenance Tracking

All maintenance tracking was done by SCS through annual status reviews. SCS technicians often drove by practices on their way to other work activities. Some practice sites were visited several times at various stages of development and use. This helped to avoid any misunderstandings producers may have had regarding the maintenance of certain practices. SCS also inspected many practices following severe storm events which could have caused damage.

It is felt by technicians that funds should be left on hand following completion of the project in order to maintain several practices that could sustain damage. Many practices are costly and too important to allow to deteriorate.

Assessment of Assistance Provided by Federal and State Agencies

The LCC structured and assigned responsibilities to each agency involved in the project.

ASCS Responsibilities:

*Chair the LCC and the Executive Subcommittee; serve on the I&E and TAC subcommittees

*Coordinate the development of the Project Plan of Work.

*Administer the RCWP through the Ainsworth ASCS office:

(1) accept applications for contracts
(2) prepare and approve contracts
(3) carry out funds control
(4) issue cost-share payments
(5) administer contracts and payments
(6) assure contract compliance
(7) maintain records and develop reports.

*Enter into working agreements with federal, state and local agencies and others as needed, for assistance to be provided in the project area.

*Work with land users in the project area to encourage participation in the RCWP and the installation of BMPs.

*Develop cost-share rates for installing BMPs.

*Assure that the RCWP is coordinated with other related farm and conservation programs.

*Develop, carry out, and annually review the Annual Plan of Work.

*Evaluate the project's effectiveness in improving water quality with the assistance of the EPA, NDEC and LCC.

The RCWP is one of many programs administered by the ASCS. As an experimental program, the Long Pine RCWP was the only project of its kind in the state. It was not known how much time would be needed to properly administer this program. At the beginning of the project, the ASCS requested but did not receive a full-time person to devote to the RCWP.

After the 1985 Farm Bill was written, the ASCS was inundated with complex feed grain programs in which a majority of producers in the area participated.

Throughout the busiest years of BMP implementation, the ASCS was inundated with new program participation. In 1986, the Ainsworth ASCS office had 11 million bushels of grain under loan in the Price Support Program. Feed Grain program participation was 93-95% and the Conservation Reserve Program (CRP) was underway. These programs generated a tremendous workload for the ASCS. The ASCS was unable to devote a great deal of time to RCWP.

SCS Responsibilties:

*Participate on the LCC, chair the TAC and serve on the Executive and I&E subcommittees;

*Recommend to the ASCS, appropriate agencies or groups that can provide technical assistance for each BMP. Coordinate technical assistance.

*Provide technical assistance in developing and certifying technical adequacy of a participant's water quality plan.
*Assist in project monitoring and evaluation.

*Provide technical assistance for the project's I&E program.

*Provide resource data for the MNNRD and COC to use in determining a participant's eligibility and priority for technical assistance.

*Provide technical assistance to land users applying for technical assistance.

*Provide technical assistance to land users applying or maintaining BMPs.

The SCS had the main responsibility for the planning, installation and maintenance of BMPs for each farm under contract. The SCS first reviewed each farm to determine the amount of acres in the critical area. The SCS then developed a water quality plan for each farm. Practices were planned that would address the specific NPS pollution problems on each farm. The SCS established a contract period. This was the length of time that would be necessary for the practices to be installed. Contract periods generally ran from three to ten years.

Throughout the implemention period, the SCS provided a wide variety of technical assistance needed for each BMP. The SCS was responsible for the annual status reviews for each contract. Each year technicians reviewed contracts with each producer. The maintenance and adequacy of the existing BMPs were discussed. Modifications were made where necessary, and the following year's BMPs were planned. Annual status reviews were very time consuming.

At the beginning of the project, the SCS had six full-time and one part-time employee in the Ainsworth office. There are currently two full-time employees. During the peak years of BMP implementation, the SCS was also inundated with new USDA programs initiated by the 1985 Farm Bill. Priority and urgency was given to the new programs. The RCWP work backed up. The LCC discussed the need for additional SCS technicians and engineers at least 20 times. During that period, the SCS went from seven employees to two. This seriously affected contract schedules. Many practices had to be rescheduled.

CES Responsibilities:

*Serve on the LCC and the Executive and Technical subcommittees and Chair the I&E subcommittee.

*Develop, implement and coordinate the RCWP I&E program.

*Provide technical assistance for BMPs 15 and 16.

*Assist in project monitoring and evaluation.

The CES was responsible for all I&E in the project. Their extensive activites are reported in Chapter 4 - I&E Activities.

NDEC Responsibilities:

*Serve as a member of the LCC and SCC.

*Monitor water quality and evaluate the effectiveness of BMPs to improve water quality and beneficial uses of water.

*Assist with coordinating water quality programs in the project areas.

*Serve as a liaison between the LCC and managers of non-agricultural sources of nonpoint pollution (e.g. pollution from roadsides, sewage treatment plants, sanitary landfills);

*Serve as a liaison between the LCC and managers of agricultural and non-agricultural point source pollution.

The NDEC, assisted by other agencies, was responsible for the Water Quality Monitoring plan throughout the project period. This included a five year baseline data collection study, and an intensive three year post monitoring project that will be initiated in 1992, (see Chapter 6-Water Quality Monitoring).

NGPC Responsibilities:

*Serve on the LCC and TAC subcommittee.

*Help develop all wildlife related BMPs.

*Provide technical assistance for planning, applying and maintaining wildlife related BMPs.

*Assist in project monitoring and evaluation.

The NGPC contributed greatly to RCWP development, implementation and success. In addition to technical assistance and biological data collection, the NGPC provided financial assistance for practices that provided wildlife benefits. The NGPC provided a great deal of assistance for BMP 10-Streambank Stabilization.

The NGPC contributed the 25% cost-share required by the producer for many practices that were installed for streambank stabilization. Fencing was cost-shared when used to exclude livestock from creeks and streams. Reed Canarygrass was provided for the headwaters and many other areas along Long Pine Creek. Sod clumps were also provided to stabilize eroding banks and narrow the creek channel (see Chapter 3-Implementation Results; BMP 10-Streambank Stabilization, Cedar Revetments).

The NGPC monitored fish communities on Long Pine Creek and its major tributaries as part of the baseline study for the project. Fish populations are a barometer reflecting watershed conditions. This biological monitoring will help determine the effectiveness of specific BMPs.

Middle Niobrara Natural Resource District (MNNRD) Responsibilities:

*Serve on the LCC and I&E-TAC subcommittees.

*Help promote the RCWP and seek additional cost-share support from state funding sources.

*Together with COC, review RCWP-1s and determine the priority for technical assistance among applicants using the criteria that the LCC has developed.

*Help the SCS provide technical assistance in planning application and maintenance of BMPs.

The Natural Resource Districts (NRDs) were established by the State Legislature in 1972. They were given a wide array of authorities including: soil and water conservation, water quality, recreation development, flood control and wildlife habitat management. NRDs were also granted the ability to levy property taxes to fund staff, equipment and programs. Each NRD is governed by a 5-21 person board made up of residents living in the district. The MNNRD has 2.9 million acres and 9,100 people in its territory.

The MNNRD made significant contributions in technical assistance and funding to the RCWP. Most of the direct funding involved projects such as groundwater monitoring stream sampling and actual project construction. The district contributed manpower and equipment to several projects. The MNNRD estimates that they have provided over 2,100 hours of staff assistance to this project. The total estimated NRD contribution to RCWP is $48,800.

The MNNRD was actively involved in the watershed before the RCWP was initiated. The district assisted SCS with surveying the watershed and collecting background data in order to develop maps for the program. The MNNRD assisted in preparing the RCWP application and in establishing appropriate BMPs for the area.

In 1988, the district developed a two year ground and surface water sampling program. The results indicated that the nitrate levels were increasing in the Brown County area, especially in the area east of Ainsworth, in the critical area.

In 1989, the MNNRD (with NDEC), developed an intensive one year water quality study of Bone Creek. The plan called for over 290 water samples to be collected during a 12 month period. Most of the sampling was concentrated during the six month period from April - October. The cost of the study was $13,800. The NRD received a grant through the NDEC under the federal Clean Water Act for this study.

Bone Creek is a major tributary of Long Pine Creek. Most of the water quality problems result from high bacterial levels attributed to point sources. One of the objectives of the study is to determine the impact of feedlots on water quality. During the past decade, several feedlots along the creek have improved their waste management systems. Nine sampling sites along the 21 mile stream were selected. Field work was completed in 1990 and data is currently being analyzed.

The MNNRD is also responsible for drop structures recently installed at the Long Pine Creek headwaters. The gabion rock structures were constructed in 1991 at a cost of $61,000. The project will also include installation of fencing and develop an education program to demonstrate the benefits that the structures will provide. To help defray the cost of the project, the MNNRD received a grant of $57,000 through the NDEC under section 319 program of the federal Clean Water Act.

The LCC determined that some type of grade control structure was needed at the headwaters where a severe headcut problem exists. In 1986, a five foot headcut was found to have advanced 20 feet in less than four months. In 1987 the headcut advanced another 400 feet. The drop structures installed will form an overfall which will stop an advancing headcut problem.

NFS Responsibilities:

*Serve on the LCC and the TAC subcommittee.

*Provide technical assistance in planning, applying and maintaining forestry-related BMPs.

*Help land users develop water quality plans.

*Assist in project monitoring and evaluation when requested.

EPA Responsibilities:

*Participate on the LCC, if requested.

*Furnish information from the water quality management process, which will help the LCC identify areas with the most critical water quality problems.

*Assist with project monitoring and evaluation at LCC's request.

The NDEC provided the assistance assigned to EPA.

ERS Responsibilities:

*Participate on the LCC when requested.

*Make Data available from existing and planned ERS surveys relating to water quality and other matters that are pertinent to the RCWP.

*Assist in evaluation of the project if requested.

The ERS was not involved in the RCWP.

ARS Responsibilities:

*Participate on the LCC if requested.

*Provide technical assistance with project monitoring and evaluation.

The ARS was not involved in the RCWP.

Ainsworth Irrigation District (AID) Responsibilities:

*Serve in an advisory capacity to the LCC.

*Assist in identifying critical pollution source areas requiring treatment.

*Serve on the I&E and TAC subcommittees.

The AID provided a great deal of technical assistance and funding. The AID delivers water to irrigate 35,000 acres in the watershed. Their knowledge of irrigation runoff, structures, etc., was vital in the planning and implementation of many practices throughout the watershed, (see Chapter 3 - Implementation Results; BMP 13 - Improving an Irrigation and/or Water Management System, Ainsworth Irrigation Project).

Long Pine Landowners Assn. (LP Landowners) Responsibilties:

*Serve in an advisory capacity on the LCC and on the I&E subcommittee.

*Aid and assist the RCWP at the LCC's request.

The LP Landowners was actively involved in attempting to get a structure at the Long Pine Creek headwaters throughout the life of the project. LP Landowners felt that the NPS pollution problems throughout the watershed were directly related to the headcut at the headwaters. The LP Landowners believed that a major structure (located at the headwaters) would solve much of the sedimentation problems which were occuring throughout the watershed. Much discussion centered around what type of structure would best address the headcut problem.

Priority was originally assigned to the headwaters. Several studies conducted by the SCS and NDEC technicians concluded that a more serious problem was occuring along Sand Draw and Bone Creeks due to streambank erosion on a major scale. The LP Landowners disputed the studies' findings and suggested that they not be accepted by the LCC. Some members of the LCC wanted to adjust priorities according to the studies. The LP Landowners wanted priorities to remain at the headwaters. This sparked a debate that continued throughout the project period.

Fertilizer and Pesticide Representative's Responsibilities:

*Serve in an advisory capacity to the LCC.

*Act as a liaison between the LCC and fertilizer and pesticide applicators in the project area.

FmHA's Responsibilities:

*Participate on the LCC, as requested.

*Coordinate farm loans and grant programs with the RCWP.

FmHA was not actively involved in RCWP.

North Central Nebraska Resource, Conservation and Development (RC&D) Responsibilities:

Although responsibilities were never assigned to RC&D, they played a vital role in the project. RC&D is not an agency. It is a USDA program created to assist in the use of resources and in rural economic development. The program is administered by the SCS. Program direction comes from a council comprised of county commissioners, Natural Resource Directors and special interest groups.

The RC&D's greatest contribution to RCWP was the installation of several Roadside Critical Area Treatments (CATs). Roadside erosion was considered a point source of pollution and therefore not eligible for cost-share funds under the RCWP.

However, roadside erosion was seriously degrading many areas of the watershed. There are very few paved roads in the watershed. County roads are not only necessary for local transportation, but for the transportation of all commodities to and from the farms and ranches. Thus all roads are heavily accessed at all times of the year. The sandy nature of the soils make them particularly susceptible to wind and water erosion. CATS were installed where roadside erosion was severely degrading creeks and streams.
This generally occurs along slopes where roads wind down into valleys or draws crossing creeks and streams. Protective vegetation along roadside ditches becomes diminished and eventually eliminated. These areas become water eroded gullies which dump tons of sediment into creeks and streams annually.

A Roadside Critical Area Treatment (CAT) is designed to:

*Minimize water erosion along the county road.
*Reduce maintenance costs of road right-of-way and structures such as bridges at the base of the hill.
*Reduce potential sources of nonpoint sedimentation.
*Reduce or eliminate safety hazards caused by gully erosion which is associated with steep grades along county roads.
*Establish Permanent Cover.

Other benefits of CAT installation are: improved wildlife habitat, increased employment opportunities during construction, and increased environmental and recreational values.

All work is done in accordance with SCS standards and specifications. Eroded ditches and roads are shaped and smoothed. Underground outlets or risers are installed along ditches to safely transport water to the base of the hill. The ditches are seeded to adapted native grasses and mulched. The vegetation provides cover and further prevents gully erosion. The RC&D was responsible for installing six CATS in the critical area. They are:

Willow Creek Roadside CAT: Total Installation Cost: $70,000; Curtailed Soil Loss: 12,000-15,000 tons annually.

Brown County/Long Pine Roadside CAT: Total Installation Cost: $35,400; Curtailed Soil Loss: 350-400 tons annually.

McCullough Roadside CAT: Total Installation Cost: $24,000; Curtailed Soil Loss: 1,000-1,200 tons annually.

Gilg Roadside CAT: Total Installation Cost: $6,000; Curtailed Soil Loss: 200-300 tons annually. This measure was on private land. Technical assistance was provided by RC&D.

Short Pine Creek Roadside CAT: Installation Cost: $27,000;
Curtailed Soil Loss: 3,000 tons annually.

Long Pine Dump CAT: This measure was in conjunction with the city dump landfill closure. The area was shaped and covered in a non-erosive manner with a system incorporated to interrupt surface water so that it doesn't flow over the dump site. This helped correct the problem of leachate flowing out of the landfill and on into Pine Creek.

CATS have been very successful. Brown County adopted this practice and installed a similar system in the Jack Rabbit Gulch area of the county. They are very effective in reducing the maintenance costs.

These projects were funded through SCS (65% RC&D funds) and MNNRD and Brown County Commission funds providing 35%.

Economic Evaluation

Installation Costs and Cost-Shares By BMP, Year and Practice

The following series of charts addresses the installation costs of each BMP (by practice and by year) and the proportion cost-shared by RCWP. Also noted is the total amount of cost-share assistance (and percentage of total RCWP cost-share) allocated for each BMP.

BMP INSTALLATION COST AND COST SHARES — BMP 1 Permanent Vegetative Cover

PRACTICE CODE/DESCRIPTION	YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
382 Fencing	1986	145	1,353 ft	1,477	1,108	
382 Fencing	1988	47	1,436 ft	538	404	
Subtotal		**192**	**2,789 ft**	**2,015**	**1,512**	**.2%**
512 Pasture & Hayland Planting	1985	38	38 acres	1,778	1,334	
512 Pasture & Hayland Planting	1987	13	13 acres	497	373	
512 Pasture & Hayland Planting	1989	32	32 acres	1,648	1,236	
Subtotal		**83**	**83 acres**	**3,923**	**2,943**	**.3%**
550 Range Seeding	1982	65	65 acres	2,430	1,823	
550 Range Seeding	1983	65	65 acres	2,311	1,734	
550 Range Seeding	1984	34	34 acres	1,357	1,018	
550 Range Seeding	1987	224	224 acres	8,553	6,416	
550 Range Seeding	1988	190	190 acres	11,828	8,873	
550 Range Seeding	1991	20	20 acres	475	356	
Subtotal		**598**	**598 acres**	**26,954**	**20,220**	**2.4%**
556 Planned Grazing System	1984	1,153	1,153 acres	N/A	1,153	
556 Planned Grazing System	1986	632	632 acres	N/A	632	
556 Planned Grazing System	1987	225	225 acres	N/A	225	
Subtotal		**2,010**	**2,010 acres**		**2,010**	**.2%**

BMP 1 TOTAL COST/SHARE = $26,685 % OF TOTAL RCWP COST/SHARE 3.1%

NOTE: BMP 1 556 Planned Grazing System was cost/shared at $1 per acre.

BMP INSTALLATION COST AND COST SHARES

BMP 2 Animal Waste Management Systems

PRACTICE CODE/DESCRIPTION	YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
312 Waste Management System	1988	8	1 unit	7,938	5,955	.7%
313 Waste Storage Structure	1989	1	1 unit	5,993	4,496	.5%
342 Critical Area Planting	1989	.5	.5 acres	229	172	.02%
362 Diversion	1988	8	1,964 ft	3,463	2,598	.3%
382 Fencing	1989	1	693 ft	490	368	.04%
425 Waste Storage Pond	1988	9	3 ponds	7,813	5,861	
425 Waste Storage Pond	1989	1	1 pond	7,926	5,946	
425 Waste Storage Pond	1991	1	1 pond	2,381	1,786	
Subtotal		**11**	**5 ponds**	**18,120**	**13,593**	**1.6%**

BMP 2 TOTAL COST/SHARE = **$27,182**

% OF TOTAL RCWP COST/SHARE 3.2%

BMP INSTALLATION COST AND COST SHARES

BMP 5 Diversion System

PRACTICE CODE/DESCRIPTION	YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
362 Diversion	1984	70	2,420 ft	8,102	6,078	
362 Diversion	1985	247	6,113 ft	18,878	14,162	
362 Diversion	1986	190	4,755 ft	16,108	12,084	
362 Diversion	1987	85	1,484 ft	4,566	3,425	
362 Diversion	1989	38	1,324 ft	6,948	5,212	
362 Diversion	1990	46	1,953 ft	3,744	2,809	
Subtotal		**676**	**18,049 ft**	**58,346**	**43,770**	**5.1%**
362 Underground Outlet	1990	79	620 ft	2,914	2,186	.3%

BMP 5 TOTAL COST/SHARE = $45,956 % OF TOTAL RCWP COST/SHARE 5.4%

BMP INSTALLATION COST AND COST SHARES

BMP 6 Grazing Land Protection System

PRACTICE CODE/DESCRIPTION		YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
378	Pond	1990	1	1 pond	3,830	2,873	.3%
382	Fencing	1984	910	14,845.6 ft	5,104	3,829	
382	Fencing	1985	225	2,691 ft	1,394	1,046	
382	Fencing	1986	1,870	13,971 .8 ft	7,959	5,971	
382	Fencing	1987	210	1,633.5 ft	1,121	841	
382	Fencing	1988	11	5,049 ft	2,230	1,673	
382	Fencing	1989	77	870 ft	587	440	
382	Fencing	1991	246	2,955.2 ft	1,274	956	
	Subtotal		**3,549**	**42,016.1 ft**	**19,669**	**14,756**	1.7%
516	Pipeline	1984	25	450 ft	682	512	
516	Pipeline	1986	391	1,767 ft	2,820	2,115	
516	Pipeline	1989	115	2,180 ft	2,398	1,799	
516	Pipeline	1990	273	4,610 ft	5,900	4,426	
	Subtotal		**804**	**9,007 ft**	**11,800**	**8,852**	**1%**
614	Tank	1983	30	1 tank	351	263	
614	Tank	1984	3,575	8 tanks	3,050	2,288	
614	Tank	1985	824	2 tanks	780	585	
614	Tank	1986	637	2 tanks	1,150	863	
614	Tank	1987	573	2 tanks	749	562	
614	Tank	1988	191	4 tanks	1,120	840	
614	Tank	1989	500	2 tanks	909	682	
614	Tank	1990	651	7 tanks	2,241	1,681	
	Subtotal		**6,981**	**28 tanks**	**10,350**	**7,764**	

BMP 6 Continued

BMP INSTALLATION COST AND COST SHARES

BMP 6 Grazing Land Protection System

PRACTICE CODE/DESCRIPTION	YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
642 Well	1983	30	1 well	1,396	1,047	
642 Well	1984	3,631	9 wells	32,104	24,079	
642 Well	1985	3,353	5 wells	15,125	11,344	
642 Well	1986	314	1 well	5,097	3,823	
642 Well	1987	573	2 wells	10,070	7,553	
642 Well	1988	191	2 wells	6,434	4,826	
642 Well	1989	385	1 well	7,221	5,416	
642 Well	1990	651	3 wells	6,908	5,181	
Subtotal		9,128	24 wells	84,355	63,269	7.4%

BMP 6 TOTAL COST/SHARE = $97,514

% OF TOTAL RCWP COST/SHARE 11.4%

BMP INSTALLATION COST AND COST SHARES

BMP 7 Waterway System

PRACTICE CODE/DESCRIPTION		YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
342	Critical Area Planting	1984	5	5 acres	499	375	
342	Critical Area Planting	1985	2	2 acres	121	91	
342	Critical Area Planting	1987	1	1 acre	79	59	
	Subtotal		**8**	**8 acres**	**699**	**525**	**.06%**
412	Grassed Waterway or Outlet	1984	85	5 acres	4,424	3,318	
412	Grassed Waterway or Outlet	1985	26	1 acre	1,260	945	
412	Grassed Waterway or Outlet	1987	1	1 acre	540	405	
412	Grassed Waterway or Outlet	1989	37	5 acres	5,029	3,772	
	Subtotal		**149**	**12 acres**	**11,253**	**8,440**	1.0%

BMP 7 TOTAL COST/SHARE = $8,965

% OF TOTAL RCWP COST/SHARE 1.0%

BMP INSTALLATION COST AND COST SHARES

BMP 9 Conservation Tillage System

PRACTICE CODE/DESCRIPTION	YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
329 Conservation Tillage System	1985	190	190 acres	N/A	1,900	
329 Conservation Tillage System	1987	116	116 acres	N/A	1,160	
Subtotal		**306**	**306 acres**	**N/A**	**3,060**	.4%

BMP 9 TOTAL COST/SHARE = $3,060

% OF TOTAL RCWP COST/SHARE .4%

NOTE: Cost/Share is limited to lands eroding at a rate greater than soil loss tolerance. Cost/Share funding was $10 per acre.

BMP INSTALLATION COST AND COST SHARES

BMP 10 Stream Protection System

PRACTICE CODE/DESCRIPTION		YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
322	Channel Vegetation	1985	5	5 acres	479	359	
322	Channel Vegetation	1988	1	1 acre	214	161	
	Subtotal		**6**	**6 acres**	**693**	**520**	**.06%**
382	Fencing	1984	2	3,377 ft	1,543	1,157	
382	Fencing	1985	118	5,310 ft	2,956	2,217	
382	Fencing	1987	46	1,405 ft	451	338	
	Subtotal		**166**	**10,092 ft**	**4,950**	**3,712**	**.4%**
580	Streambank Protection (CR)	1984	23	5,742 ft	19,381	14,536	
580	Streambank Protection (CR)	1985	11	5,474 ft	15,106	11,330	
580	Streambank Protection (CR)	1986	10	5,736 ft.	15,777	11,833	
580	Streambank Protection	1988	2	904 ft	1,261	946	
	Cedar Revetments			(504 ft)		(771)	
	Wing Dikes			(400 ft)		(175)	
580	Streambank Protection	1989	5	1,435 ft	3,652	2,739	
	Cedar Revetments			(985 ft)		(1,891)	
	Wing Dikes			(450 ft)		(848)	
	Subtotal		**51**	**19,291 ft**	**55,177**	**41,384**	**4.8%**

BMP 10 TOTAL COST/SHARE = $45,616

% OF TOTAL RCWP COST/SHARE 5.3%

NOTE: CR = Cedar Revetments

BMP INSTALLATION COST AND COST SHARES

BMP 11 Permanent Vegetative Cover on Critical Area

PRACTICE CODE/DESCRIPTION		YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
342	Critical Area Planting	1984	1	1 acres	250	188	
342	Critical Area Planting	1985	13	13 acres	1,428	1,071	
342	Critical Area Planting	1986	14	16 acres	5,227	3,920	
342	Critical Area Planting	1987	7	7 acres	377	283	
342	Critical Area Planting	1988	1	1 acre	168	126	
342	Critical Area Planting	1989	2	2	133	100	
342	Critical Area Planting	1991	2.5	2.5 "	69	52	
	Subtotal		**40.5**	**42.5**	**7,652**	**5,740**	**.7%**
382	Fencing	1983	1.5	808.5 ft	375	281	
382	Fencing	1985	1	643.5 ft	212	159	
382	Fencing	1986	133	7,646 ft	3,719	2,789	
	Subtotal		**135.5**	**9,098 ft**	**4,306**	**3,229**	**.4 %**
484	Mulching	1986	6	3 acres	552	414	
484	Mulching	1987	7	7 acres	284	213	
484	Mulching	1989	1	1 acre	196	147	
	Subtotal		**14**	**11**	**1,032**	**774**	**.09%**

BMP 11 TOTAL COST/SHARE = $9,743 % OF TOTAL RCWP COST/SHARE 1.1%

BMP INSTALLATION COST AND COST SHARES

BMP 12 Sediment Retention, Erosion or Water Control Structures

PRACTICE CODE/DESCRIPTION		YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
342	Critical Area Planting	1986	2	2 acres	58	44	-
350	Sediment Basin	1986	196	1 unit	3,840	2,880	
350	Sediment Basin	1988	1	1 unit	4,349	3,262	
	Subtotal		**197**	**2 units**	**8,189**	**6,142**	.7%
382	Fencing	1985	1	1,006.5 ft	555	416	.05%
410	Grade Stabilization Struc.	1985	40	1 unit	26,765	20,074	
410	Grade Stabilization Struc.	1987	158	2 units	16,600	12,340	
410	Grade Stabilization Struc.	1991	144	3 units	46,541	34,907	
	Subtotal		**342**	**6 units**	**89,906**	**67,431**	7.9%
587	Structure for Water Control	1989	125	4 units	2,837	2,128	
587	Structure for Water Control	1991	1	1 units	1,737	1,303	
	Subtotal		**126**	**5 units**	**4,574**	**3,431**	.4%
638	Water & Sed. Control Basin	1984	1	1 basin	12,930	9,698	
638	Water & Sed. Control Basin	1985	1	28 basins	1,654	1,241	
638	Water & Sed. Control Basin	1986	334	13 basins	2,464	1,848	
638	Water & Sed. Control Basin	1990	2	2 basins	6,744	5,058	
	Subtotal		**338**	**44 basins**	**23,792**	**17,845**	2.1%

BMP 12 TOTAL COST/SHARE = $95,309

% OF TOTAL RCWP COST/SHARE 11.1%

PRACTICE CODE/DESCRIPTION	YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
449 Irrigation Water Management	1984	276	276 acres	703	528	
449 Irrigation Water Management	1985	106	106 acres	6,674	5,006	
Subtotal		**382**	**382 acres**	**7,377**	**5,534**	.6%
430 Pipeline	1982	125	1,515.5 ft	4,577	3,433	
430 Pipeline	1984	162	1,936 ft	6,528	4,896	
430 Pipeline	1985	76	10,886 ft	4,312	3,234	
430 Pipeline	1986	412	9,771 ft	44,486	33,365	
Pipeline			(5,821 ft)		(6,525)	
Gated Pipe			(3,950 ft)		(26,840)	
430 Pipline	1987	553	8,517 ft	17,938	13,454	
430 Pipeline	1988	81	1,914 ft	11,802	8,852	
430 Pipeline	1989	243	5,488 ft	19,524	14,643	
430 Pipeline	1990	300	3,288 ft	8,382	6,287	
Pipeline			(2,376 ft)		(3,827)	
Gated Pipe			(912 ft)		(2,460)	
430 Pipeline	1991	89	1,789 ft	8,818	6,614	
Pipeline			(589 ft)		(2,409)	
Gated Pipe			(1,200 ft)		(4,205)	
Subtotal		**2,041**	**45,104.5 ft**	**126,367**	**94,778**	
587 Structure for Water Control	1985	106	12 units	5,160	3,870	
587 Structure for Water Control	1987	101	2 units	387	290	
587 AID & Pooling Structure	1987	6,250	1 unit	249,319	186,994	
587 Structure for Water Control	1988	27	2 units	1,223	917	
587 Structure for Water Control	1990	134	1 unit	303	227	
587 Structure for Water Control	1991	46	1 unit	1,466	1,100	
Subtotal		**6,664**	**19 units**	**257,858**	**193,398**	22.6%

BMP 13 continued

BMP INSTALLATION COST AND COST SHARES

BMP 13 Improving an Irrigation and/or Water Management System

PRACTICE CODE/DESCRIPTION	YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
447 Ir Sys Tailwater Recovery	1982	125	1 unit	5,097	3,823	(1,335 cuyds)
447 Ir Sys Tailwater Recovery	1984	114	1 unit	5,563	4.172	(1,559 cuyds)
447 Ir Sys Tailwater Recovery	1985	387	6 units	66,378	49,785	
Powerlines			5,202 ft		(11,492)	
Pumps			4 pumps		(8,491)	
Structures			9,135 cuyds		(29,802)	
447 Ir Sys Tailwater Recovery	1986	540	5 units	24,381	18,286	
Powerlines			4,037 ft.		(4,709)	
Pumps			2 pumps		(4,341)	
Structures			7,515 cuyds		(9,236)	
447 Ir Sys Tailwater Recovery	1987	449	4 units	35,855	26,892	
Powerlines			2,425 ft.		(4,430)	
Pumps			2 pumps		(7,549)	
Structures			5,339.7 cuyds		(14,913)	
447 Ir Sys Tailwater Recovery	1988	81	2 pumps	8,922	6,692	
447 Ir Sys Tailwater Recovery	1989	148	2 units	14,117	10,588	
Powerline			470 ft		(2,004)	
Pumps			2 pumps		(8,584)	
447 Ir Sys Tailwater Recovery	1990	1	1 unit	24,054	18,041	
Powerlines			1,490 ft		(5,937)	
Pumps			3 pumps		(8,363)	
Structures			1,575.1 cuyds		(3,714)	
447 Ir Sys Tailwater Recovery	1991	162	1 unit	10,317	7,738	
Powerline			1,200 ft			
Pumps			2 pumps			
Structure			2.5 cuyds			
Subtotal				194,684	146,017	17.0%

BMP 13 TOTAL COST/SHARE = $439,727 % OF TOTAL RCWP COST/SHARE = 51.3%

BMP INSTALLATION COST AND COST SHARES

BMP 14 Tree Planting

PRACTICE CODE/DESCRIPTION		YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
382	Fencing	1984	1	518.1 ft	24	18.50	
382	Fencing	1986	25	16,681.5 ft	7,499	5,625	
382	Fencing	1987	17	1,567.5 ft	544	408	
382	Fencing	1988	3.4	3,887.6 ft	1,968	1,476	
382	Fencing	1989	6	4,270.7 ft	1,612	1,209	
382	Fencing	1990	12.8	2,799 ft	1,151	863	
	Subtotal		65.2	29,724.4 ft	12,798	9,599.50	1.1%
441	Irrigation Drip System	1988	1	1 unit	1,071	803	.09%
612	Tree Planting 1,000 trees	1982	3	3 acres	507	380	
612	Tree Planting 1,250 trees	1984	6	6 acres	482	361.50	
612	Tree Planting 400 trees	1985	2	2 acres	244	183	
612	Tree Planting 15,157 trees	1986	38	28 acres	8,060	6,045	
612	Tree Planting 2,300 trees	1987	5	2 acres	837	628	
612	Tree Planting 1,124 trees	1988	2.2	2.2 "	684	513	
612	Tree Planting 1,484 trees	1989	3.7	3.7 "	1,579	1,184	
612	Tree Planting 1,192 trees	1990	4.6	4.6 "	660	495	
612	Tree Planting 50 trees	1991	1	1 acre	21	16	
	Subtotal 23,957 trees	(7,501 were replants)			13,074	9,805.50	1.

BMP 14 TOTAL COST/SHARE = $20,208

% OF TOTAL RCWP COST/SHARE 2.4%

BMP INSTALLATION COST AND COST SHARES

BMP 15 Residual Nitrate Management

PRACTICE CODE/DESCRIPTION	YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
384 Fertilizer Management	1983	223	223 acres	N/A	223	
384 Fertilizer Management	1984	1,395	1,395 acres	N/A	1,395	
384 Fertilizer Management	1985	579	579 acres	N/A	579	
384 Fertilizer Management	1986	4,006	4,006 acres	N/A	4,006	
384 Fertilizer Management	1987	5,466	5,466 acres	N/A	5,466	
384 Fertilizer Management	1988	4,130	4,130 acres	N/A	4,130	
384 Fertilizer Management	1989	1,574	1,574 acres	N/A	1,574	
384 Fertilizer Management	1990	1,144	1,144 acres	N/A	1,144	
384 Fertilizer Management	1991	720	720 acres	N/A	720	

BMP 15 TOTAL COST/SHARE = $19,237   % OF TOTAL RCWP COST/SHARE 2.2%

NOTE: 384 Fertilizer Management was Cost/Shared at $1 per acre. Producers participated for five years, but were paid for the first three years participation only. Beginning in 1986 participants were paid in the year following completion of the practice. Thus most of the 1986 payments were actually performed in 1985. The same is true for 1987-1991.

BMP INSTALLATION COST AND COST SHARES — BMP 16 Pesticide Management

PRACTICE CODE/DESCRIPTION	YEAR	ACRES SERVED	UNITS APPLIED	INSTAL. COST($)	COST SHARE($)	% OF TOTAL COST SHARES
514 Pesticide Management	1983	223	223 acres	N/A	223	
514 Pesticide Management	1984	1,786	1,786 acres	N/A	1,786	
514 Pesticide Management	1985	523	523 acres	N/A	523	
514 Pesticide Management	1986	4,422	4,422 acres	N/A	4,422	
514 Pesticide Management	1987	5,218	5,218 acres	N/A	5,218	
514 Pesticide Management	1988	3,875	3,875 acres	N/A	3,875	
514 Pesticide Management	1989	1,061	1,061 acres	N/A	1,061	
514 Pesticide Management	1990	1,230	1,230 acres	N/A	1,230	

BMP 16 TOTAL COST/SHARE = $18,338 — % OF TOTAL RCWP COST/SHARE 2.1%

NOTE: 514 Pesticide Management was Cost/Shared at $1 per acre. Producers participated for five years, but were paid for the first three years participation only. Beginning in 1986 participants were paid in the year following completion of the practice. Thus, most of the 1986 payments were actually performed in 1985. The same is trtue for 1987-1991.

Total RCWP Project Expenditures (Technical Assistance, Financial Assistance, I&E)

The total amount of RCWP cost-share expenditures as of the end of April, 1991 was $857,540. I&E expenditures provided to CES from the beginning of the project through 1990 total $230,605. Technical funds earned by the SCS from fiscal 1983-1991 were $422,659.

In 1981, the total amount of BMP cost-share funds approved for the Long Pine RCWP was $1,355,875. A total of $375,000 was returned by the LCC in 1990. Of this amount, $300,000 was to be allocated to the NDEC for the post-monitoring project, and $75,000 was returned to Washington. The return of funds was premature. By 1990, additional funds were needed to complete practices scheduled in contracts. The LCC was able to obtain the additional funds needed for cost-share on RCWP practices remaining in the contracts. The remaining practices are scheduled to be completed in 1992.

Cost Effectiveness of BMPs in Reducing Pollutant Loadings

The cost effectiveness of BMPs in reducing pollutant loadings will be better understood following the three year post monitoring study. It is currently not known the exact degree of reduced pollutant loadings that can be attributed to specific BMPs.

Impacts of BMPs on Producer's Cost and Returns

Several practices had an immediate impact on producer's costs and returns. BMP 15-Residual Nitrate Management, and BMP 16-Pesticide Management provided immediate economic benefits to producers as less chemical applications were necessary without a sacrifice in yields. The estimated reduction in nitrogen fertilizer application at the end of 1990 was 1,300,000 pounds, or about 35 pounds per acre. This represents approximately $260,000. The reduction in pesticide use has generated a savings of approximately $210,000.

Many small dams constructed under BMP 12-Sediment Retention or Water Control Structures, were considered cost-effective when compared with the cost of a large structure.

Practices under BMP 13-Improving an Irrigation and/or Water Management System, were very expensive. Most of these practices would not have been constructed without RCWP cost-share funds. These practices have been very well received because they provide an extremely efficient use of water and control runoff. However, they do not provide immediate economic benefits. Water is so cheap, it is more economical to let excess water run off the field (and order more) than to pump it back onto the field for reuse. This has discouraged many producers from constructing tailwater recovery units on their farms. The 1988-1989 drought made producers aware of the importance of recycling irrigation runoff. Producers are very interested in tailwater recovery systems to the extent that some have installed them at their own expense.

Off-Site Benefits of RCWP (Impaired Water Uses Before and After RCWP)

The three year post-monitoring study by NDEC will evaluate the actual degree of impaired water uses after RCWP. Many BMPs have, however, already begun to demonstrate benefits outside the critical area.

BMP 1-Permanent Vegetative Cover and BMP 10-Streambank Stabilization, have improved wildlife habitat. BMP 15-Residual Nitrate Management, and BMP 16-Pesticide Management were widely adopted throughout the watershed and have greatly reduced chemical pollutant loadings, along with BMP 6 - Grazing Land Protection System (fencing livestock out of creeks and streams) and BMP 2-Animal Waste Management System. BMP 13-Improving an Irrigation and/or Water Management System has greatly controlled agricultural runoff throughout the watershed.

RCWP has created a greater public awareness of water quality problems and solutions.

CHAPTER 6—MONITORING PROGRAM DESCRIPTION

Findings and Recommendations

*Monitoring programs should be holistic. Consideration should be given to water quality, habitat quality, biotic integrity, water quantity, land treatment, and land use.

*It is critically important that a monitoring project plan be prepared which clearly defines how the monitoring program will be implemented, and how the effectiveness of the project will be evaluated. The plan should include: 1) clearly and narrowly defined monitoring objectives; 2) a project description which identifies the monitoring network design and rationale, the parameters to be monitored, and their frequency and method of collection; 3) monitoring fiscal information; 4) a schedule of tasks and products; 5) personnel responsibilities; 6) data management provisions; 7) reporting requirements; and 8) appropriate quality assurance/quality control provisions.

*Monitoring should allow for water quality assessment by hydrologic units. A "paired watershed" or "up-stream-downstream" monitoring design should be used whenever possible.

*Extensive monitoring using a "laundry-list" approach should be avoided. Relationships should be discerned between NPS pollutants and loadings and their impacts on beneficial uses. These relationships should be used to identify critical parameters, including covariates, for monitoring.

*Direct measures of beneficial use support (e.g. aquatic biota occurrence, embryo survival, etc.) should be used whenever possible. The use of such information may require utilization of reference sites.

*Variability attributed to flow and seasonality are often ignored in monitoring water quality. These sources of variability are important in assessing water quality and must be accounted for to the degree possible.

*BMP effectiveness monitoring is important in that it provides feedback to project participants and it allows the success of BMPs implemented as part of the project to be evaluated.

*Land treatment and land use information should be tracked by hydrologic units to facilitate evaluation of BMP effectiveness. Procedures for documenting

land use and land treatment data must be established and a database maintained.

*Land use and land treatment within the project area, both participants and nonparticipants, should be tracked in the land treatment data base. Land treatment data tracking should not end with contract expiration if the project is still ongoing.

*Water quality monitoring and watershed evaluation results should be used by resource managers as much as possible to identify critical areas and in selecting and prioritizing BMPs.

Water Quality Information

Water quality monitoring is of utmost importance in an experimental program. The very nature of an **experiment** implies a **result**. In the RCWP, both water quality monitoring data and land treatment data must be thoroughly documented. Thorough documentation of these data are needed to evaluate BMP effectiveness and the effectiveness of the program in general.

The Long Pine RCWP was fortunate in that a large amount of pre-implementation data reflecting past conditions had previously been collected. The U.S. Geological Survey (USGS) has been monitoring surface water quality and flow on Long Pine Creek since 1948. Both municipal and domestic water supplied from ground water were monitored by the Nebraska Department of Health throughout the 1970s. The NGPC has conducted numerous fish population studies determining abundance of distribution of fish species throughout the area. The LPRCWP was also fortunate in that an extensive surface water quality monitoring project was initiated in 1979 by the NDEC. This study continued through 1985 and is the primary source of pre-implementation baseline data to be utilized for project evaluation. The pre-implementation monitoring results are published in the report "Water Quality in the Long Pine Rural Clean Water Project 1979-1985" - authored by Terry Maret, (NDEC 1985).

Climate/Meterologic/Hydrologic/Land Use

The collection and evaluation of data is complex and presents a continuing challenge to technical experts. Experts must develop techniques and strategies which will allow for a complex array of diverse and interrelated variables to be assessed. Hydrologic and meterologic processes such as precipitation, storm intensity and frequency, stream flow, ground water depth, and humidity must be considered in addition to land use activity such as crops planted, tillage methods , irrigation frequencies, chemical applications, set-aside programs etc. These must be related to an intensive collection of physicochemical and biological water quality data.

The water quality monitoring program included assessment of both ground and surface waters.

Water Quality Monitoring Design

Surface Water Quality Monitoring Strategy — by Dave Jensen, NDEC

The surface water quality monitoring strategy was originally designed to compare pre- and post-monitoring data. However, as the project developed, the strategy evolved to three phases: 1) pre-implementation monitoring; 2) monitoring during implementation; 3) post-implemetation monitoring, with the emphasis on pre- and post-monitoring.

Pre-Implementation Monitoring: The NDEC with the assistance of the SCS, NGPC, CES, MNNRD and other agencies conducted the pre-implementation monitoring in the project area. The following water quality monitoring objectives were identified by the NDEC for the pre-implementation monitoring.

1. Document existing (before BMP implementation) water quality conditions.

2. Identify existing water quality problems, including any areas where surface water quality dependent beneficial uses are impaired by land use activites.

3. Identify and prioritize areas where BMP installation will have the greatest effect.

4. Provide baseline data for evaluation of site-specific BMPs and changes in water quality.

The pre-implementation monitoring included sampling of ambient stream conditions, instream runoff conditions, and rainfall within the project area. The monitoring attempted to evaluate the entire surface water ecosystem. Stream conditions were monitored at 11 sites (Figure 6-1) on Long Pine Creek, Bone Creek, Willow Creek and Sand Draw. The stream conditions monitored included physicochemical conditions of the water column, biological conditions (i.e., bacteria, periphyton, macroinvertebrates, fish) aquatic habitat (i.e. flow, substrate, cover), and riparian conditions along streams. Runoff samples (i.e. physicochemical conditions) were collected at six sites (LPl, LP7, LP8, BN1, BN3 and SD2). Rain gauges were maintained at four sites (LP1, LP8, SD1 and Ainsworth Airport). This information was used to document existing water quality conditions, including support of designated surface water beneficial uses (i.e., primary contact recreation, coldwater aquatic life, agricultural water supply, and aesthetics), and identify nonpoint source pollution problem areas.

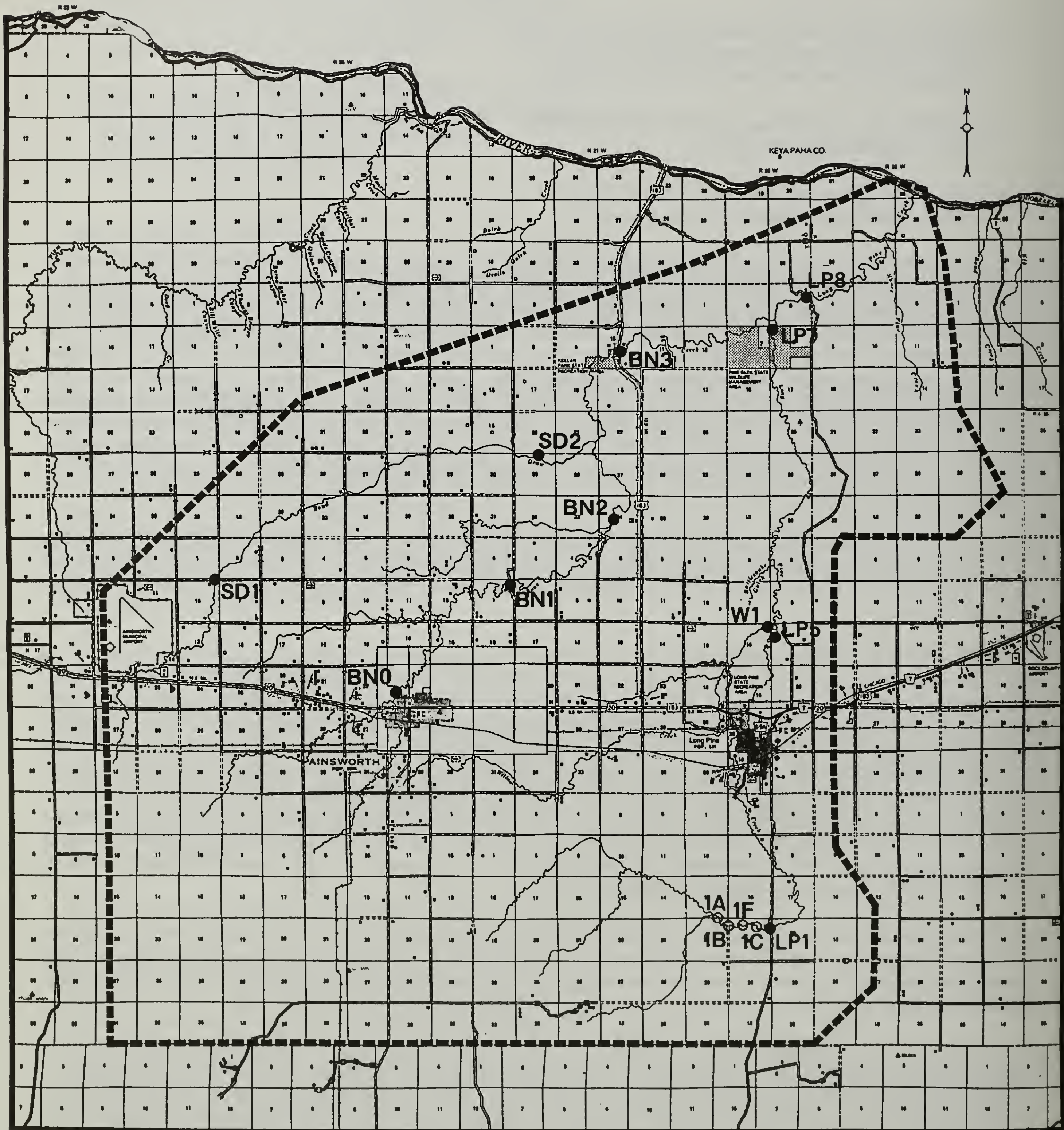
Maret's report (NDEC, 1985) documented pre-implementation surface water quality conditions. This report identified surface water quality problems based on existing or potential impairment of beneficial uses at the 11 monitored sites. The surface water quality problems identified from the pre-implementation monitoring were as follows:

Long Pine Creek: Headwaters (LP1). The water quality at this site was good. Occasionally fecal coliform bacteria were found to be in excess of the recreational criteria due to cattle waste input. The only major impaired use at this site was Aquatic Life (i.e., limited trout fishery). Due to excess sedimentation from bank and gully erosion there is very little cover or pool habitat to support a sport fishery. Substrate composition is predominantly sand with little or no gravel for natural reproduction of trout. The highly erosive Duffy formation along this reach magnify the severity of runoff events. Sediment transport is very low during normal flow due to a low gradient. The stream damage occurs during high flows of major runoff events. Runoff water above the inception of Long Pine Creek is relatively sediment free. However, as water continues to travel down the stream, the sediment load greatly increases. This erosion, caused by high flows, increases the deposition of sand and consequently the degradation of fish habitat. A significant headcutting problem was identified in the upper reaches of Long Pine Creek.

BMPs to protect streambanks such as vegetative plantings, fencing, cover structures and re-routing channels around highly erosive Duffy formations should be a high priority. Retarding peak flows from rangeland by slow, small release structures or vegetative stripping of drainages are other alternatives to complement the stream-side BMPs.

Long Pine Creek: Mid-Reaches (LP5, LP7). Water quality was good at these sites. There were no beneficial use impairments which could be documented at these locations. The cover and substrate is adequate to provide a viable self-sustaining trout fishery. However, salmonid spawning may need to be further assessed to determine to what degree it is being supported. The stream reach in the vicinity of LP7 has potential to provide a greater standing crop of trout. If instream cover were improved, creating more pool habitat, localized improvements in sport fishing could occur.

Figure 6-1. Surface Water Quality Monitoring Sites within the Long Pine RCWP Project Area.



• Baseline Monitoring Site

○ Headwaters Monitoring Site

Long Pine Creek: Lower Reaches - Below Confluence with Bone Creek (LP8). The water quality was degraded at this site due to the contributions of Bone Creek. Primary contact recreation and aquatic life uses are impaired the last six miles of Long Pine Creek. High bacterial counts at this station, possibly due in large part to point source discharges along Bone Creek, impair its use. Summer water temperatures seemingly restrict the cold-water fisheries in the lower reaches of Long Pine Creek. This is due to warmer water entering Long Pine Creek from Bone Creek. The extremely high sediment load found at this location, especially in the summer, creates an unproductive environment for aquatic life. This excessive sediment destroys food producing organisms, buries gravel needed for trout spawning and fills in the pool habitats requried for good trout production.
The lower reach of Long Pine Creek, from the Bone Creek confluence to the Niobrara River, has a high potential for showing improvements. The fisheries potential of this reach is apparent during the spring, winter and fall months. During these seasons large trout have been collected below Bone Creek. Also, during this time, the stream narrows and deepens and the substrate becomes scoured, exposing gravel bars. Sediment transport also drastically declines during this period which improves the overall water quality.

Bone Creek: Headwaters (BNO). This site had good water quality with the exception of fecal coliform bacteria, which often exceeds recreational criteria. During runoff events this site carries an unusually low suspended solids load, an indication the headwaters contribute relatively little sediment to downstream waters. The fish community is diverse and abundant; however, it is not a viable sport fishery due more to its size rather than water quality or habitat. The headwaters section of Bone Creek is a relatively rare and unique aquatic resource based on the fish community; threatened species, Pearl dace (Semotilus margarita), and Northern Redbelly dace (Phoxinus eos), are found in this reach of the stream.

Bone Creek: Mid-Reaches (BN1, BN2). The water quality at both these locations was degraded. Feedlot wastes, wasteway water, irrigation runoff, Ainsworth sewage treatment plant effluent and excessive erosion along unprotected streambanks and adjacent gullies are the primary pollution sources. Fecal coliform bacteria is almost always in excess of primary contact recreational criteria. Extreme nonpoint source loadings are contributed to the stream during runoff events. The highest concentrations of sediment, organic waste and nutrients documented during the Phase 1 monitoring were at these sites. The fishery at these sites is also impaired. Threatened species found in the headwaters of Bone Creek have not been collected from this lower stretch of stream. Also, the number of fish species and individuals present indicate stressed conditions. The fish habitat appears to be adequate for supporting a diverse community. Water quality appears to be the primary factor limiting this section of Bone Creek. There is a high potential in showing improvements of beneficial uses at these locations with appropriate BMP implementation.

Bone Creek: Lower Reaches (BN3). The stream at this point was much different than at BN2. The channel is much wider and shallower, has substantially less riparian vegetation and carries a much greater sediment load. The addition of sediment from Sand Draw is the primary reason for the major change in the lower section of Bone Creek. Impaired uses include aquatic life (water quality does not support a recreational use, however, a recreational use is not currently designated on Bone Creek.. Fish collections have revealed a particularly sparse fish population, especially in summer. A fish collection in the spring of 1983 revealed that trout do inhabit the lower section of Bone Creek; a few Brown trout were collected approximately four miles above Long Pine Creek. Water quality is exceptionally poor at this site during runoff periods due to the addition of feedlot wastes and sediment. Lower Bone Creek has severe water quality and habitat problems which have been well documented. The potential to show improvement is high at this site.

Sand Draw: Headwaters (SD1). The water quality at this station was good. Recreational bacteria criteria are seldom exceeded (recreation is not a designated use on Sand Draw). During periods of high flow there is little sediment transported from the drainage above this site. The fish community is diverse and abundant at this location, but does not provide a sport fishery due to the stream's small size. Northern redbelly dace, a threatened species, has been collected at this location indicating a unique aquatic resource.

Sand Draw: Lower Reaches (SD2). The water quality at this location was impacted by excessive sediment load and fluctuating flows from wasteway discharges and irrigation return flow. These conditions reduce average stream depth and increase channel width. This results in degraded fish habitat and significant warming of the water during the summer. This station exhibited more sediment transport for its size than any of the other stations monitored. Bacterial levels are high and the fish community exhibited low diversity and few individuals. The potential to show improvements of beneficial uses on lower Sand Draw is

Creek as a result of NPS loadings from Willow Creek. The potential to show improvements in Willow Creek or improvements in Long Pine Creek below Willow Creek, based on monitoring data is believed to be minimal.

Recommendations: Based on the pre-implementation monitoring results, personnel from SCS, NDEC, and NGPC recommended the following: (1) concentrate BMPs in the Sand Draw and Bone Creek subwatersheds due to the extremely poor water quality monitored in these streams; (2) emphasize installation of streambank protection and habitat improvement structures in the upper reaches of Long Pine Creek, and (3) emphasize BMPs which reduce the delivery of runoff into streams.

Monitoring During Implementation: As mentioned, the surface water quality assessment strategy for the Long Pine RCWP project was based on comparing pre-implementation and post-implementation conditions. Implementing this assessment strategy did not require surface water quality monitioring during BMP implementation. However, some surface water quality monitoring and assessment did occur during this period.

Ambient physicochemical stream conditions in Long Pine Creek at site LP8 were intermittently monitored on a monthly basis. Monthly monitoring at this site occurred from January 1984 through October 1989 and from January 1991 through the present. This data has not yet been assessed in regard to the Long Pine Creek RCWP project.

The MNNRD conducted an intesive study of the water quality of Bone Creek during the period of November 1989 to October 1990. This study focused on monitoring bacterial levels and ambient water quality in Bone Creek. During recent years, several feedlots have upgraded their livestock waste systems which should help reduce pollution inputs into the creek. The objective of the study was to determine the impact feedlots near the stream were having on the water quality in Bone Creek. Water quality conditions were determined from grab samples taken at nine sites along Bone Creek (Figure 6-2). Monthly samples were collected from November 1989 through March, 1990, and weekly samples were collected from April 1990 through October, 1990. Samples were also collected following periods of heavy precipitation. The field portion of the study was completed in October, 1990, but the results have not yet been assessed. The sampling results will be assessed by the NDEC and a report prepared in early 1992.

Installation of stream protection measures have improved the instream trout habitat and may have increased the trout carrying capacity of Long Pine Creek. The SCS and NGPC applied the Binn's (Binns et al, 1979) habitat index to Long Pine Creek based on conditions before and after cedar revetments were put into place. They found that the mean carrying capacity, as predicted by the index, increased from about 75 lb/acre to about 119 lb/acre; a 58% increase. The headcutting problem has been addressed by the MNNRD. A drop structure was installed in 1991 in the headwaters of Long Pine Creek.

Recommendations: The effectiveness of the drop structure to control headcutting in Long Pine Creek should be assessed. Headcutting appears to be having a significant affect on the sediment load in Long Pine Creek and may be impacting maintenance of beneficial uses. Accounting for the headcutting on the sediment load in Long Pine Creek will be of importance in evaluating the effectiveness of the RCWP project. The degree to which Long Pine Creek supports salmonid spawning should be better evaluated. Actual quantification of spawning success instream would greatly facilitate future water quality management actions, and the understanding of possible effects the RCWP project has had on Long Pine Creek.

A recreational use attainability study should be completed on Bone Creek. Primary Contact Recreation is currently not a designated use on Bone Creek (NDEC 1991a). It should be ascertained whether Primary Contact Recreation is an attainable use in Bone Creek. Such a determination is key to interpreting the impact of bacterial levels in Bone Creek and possible management actions. The City of Ainsworth is not currenlty required to disinfect their effluent.

Figure 6-2. Bone Creek Sites Monitored by the Middle Niobrara Natural Resources District from November 1989 through October 1990.

Contact Recreation is an attainable use in Bone Creek. Such a determination is key to interpreting the impact of bacterial levels in Bone Creek and possible management actions. The City of Ainsworth is not currenlty required to disinfect their effluent.

Post-Implementation Monitoring: Post-implementation surface water quality monitoring is scheduled to begin once all structural BMPs are in place (July, 1992) and is planned to encompass three years of field sampling. The final surface water quality data assessment will be completed nine months after field sampling ends.

The original surface water quality monitoring strategy for the Long Pine RCWP has been revised, to the extent possible, to reflect the current "lessons learned" from NPS projects. The primary goal of the post-implementation monitoring will be to collect information that may allow surface water quality improvements to be detected and attributed to BMPs implemented in the RCWP project area. This may prove to be a difficult task because of some inherent weaknesses now recognized in the original monitoring design.

Inherent weaknesses now recognized in the original surface water quality monitoring strategy include:

*Study Design - Before and after treatment comparison with single downstream station. The original study design was developed as a before and after single downstream station design within each subbasin. In this type of study design, differences in water quality due to BMPs are typically expressed as means for the two time periods, which are analyzed using the 't-test'. Recent findings have found that this may be one of the least efficient designs to use when trying to detect BMP-attributed improvements This is due to the fact that natural variation (e.g., climatic conditions) is not accounted for effectively.

All of the non-headwater subbasins (subbasin numbers 2,4,5,6,7, 10 and 11) are bracket by upstream-downstream stations. The upstream station represents the water quality entering the subbasin from the upstream subbasin, and the downstream station the water quality conditions leaving the subbasin. These station pairs bracket an area within the subbasin in which BMPs were installed. Analysis of the water quality data at these station pairs may allow a more rigorous evaluation of the effectiveness of the BMPs installed within the subbasin than afforded by a single downstream station.

A more effective sampling design may have been to utilize a paired watershed design. The paired watershed design utilizes before and after periods in two watersheds. A regression equation is used to describe the relationship between a control and treatment watershed prior to implementation of a BMP. A second regression is developed following use of the BMP and the two regressions are tested for differences in slope and intercepts. This design is much more sensitive to detecting significant water quality changes attributable to BMP implementation in that natural variability is accounted for well. The Plum Creek watershed, located just west of the Long Pine Creek

watershed, could have possibly been utilized as a paired watershed.

*Sampling Frequency - Monthly. The original monitoring design utilized monthly sampling for instream physico-chemical parameters. Accounting for natural variation is a key concern in trying to detect significant BMP-attributable changes in water quality. The more observations available, the greater the chance of accounting for natural variation and detecting a significant change. Recent findings have suggested that weekly sampling should be considered when trying to detect BMP-attributable changes in water quality.

*Monitoring Objectives - Too broadly defined. Establishing well-defined monitoring objectives is critical in making sure that the appropriate data are collected from the right sites at the right time. A monitoring objective should be narrowly and clearly defined to address a specific problem at an appropriate level of detail. Monitoring objectives should specify the primary parameter(s), location of monitoring and perhaps timing, the degree of causality or their relationship, and the anticipated result of the management action. The magnitude of the change may also be expressed in the objective.

*Monitoring Site Locations - Assessment of site-specific BMPs. One of the original monitoring objectives was to assess the effectiveness of site-specific BMPs. To effectively evaluate site-specific BMPs, monitoring sites should be located in close proximity to the BMP application site. The locations of the surface water sites monitored in the pre-implementation monitoring do not readily support a detailed assessment of site-specific BMPs; their location is more suited for assessing watershed trends. A possible exception might be for evaluating the specific effects of cedar revetments and other streambank stabilization measures.

Although some inherent weaknesses have been recognized in the original monitoring design, it does possess some inherent strengths. These inherent strengths include:

*Measurement of covariates. Covariates of parameters of primary concern were regularly measured. In the case of instream sediment and bacteria, parameters such as stream flow and rainfalll were measured. Analysis of covariate parameters in addition to primary parameters will possibly improve the sensitivity in detecting BMP-attributable water quality changes.

*Beneficial uses were directly measured - Fishery and macroinvertebrate monitoring and habitat assessment. Direct measurement of beneficial uses avoids problems in interpreting surrogate measures. Biological parameters temporally integrate environmental conditions

and can greatly facilitate relaying water quality information to the public.

The design of the original monitoring strategy will allow for the evaluation of the effectiveness of applied BMPs at the watershed/subbasin level. However, inherent weaknesses in the original monitoring design may somewhat reduce the ability of the post-implementation monitoring to detect improvements in water quality due to BMP implementation. Whether or not BMP-attributed improvements in water quality can be discerned by the post-implementation monitoring will, to a large degree, depend on the magnitude of any 'real' improvements in surface water quality conditions.

Significant reductions in NPS pollutant loadings to project area streams have been predicted due to implemented treatments (BMPs). Extensive streambank stabilization measures, including cedar revetments, have been widely implemented. Six roadside Critical Area Treatments (CATs) to reduce roadside erosion have been completed. It is estimated that the treatments have resulted in a curtailed soil loss of 19,900 tons annually. This sediment was previously deposited directly into the creek. The Ainsworth Irrigation District completed construction of a secondary storage reservoir in 1987. This storage reservoir is designed to reduce the application of irrigation water to saturated fields. Estimated potential savings could reach 2,000 acre feet of water annually, and should greatly reduce the amount of waste water entering the streams. It is estimated that this may reduce the sediment delivered to the streams in the project area by 28,000 tons per year. Tailwater recovery systems and pesticide and fertilizer management were also widely employed throughout the area. The MNNRD's drop structure addressing the headcutting in Long PIne Creek could prevent 1,851 tons of sediment from being directly delivered to Long Pine Creek. Feedlots along Bone Creek have implemented required controls to control runoff. There is a good probability that the magnitude of change these treatments may have had on surface water quality can be detectable by the post-implementation monitoring.

The 1991 Plan of Work for the Long Pine Creek RCWP project identified the following surface water quality problems within the project areas:

1. The surface water uses impaired are recreational fishing (Aquatic Life-Coldwater Class A) and swimming (Primary Contact Recreation). Sediment and bacteria are the primary pollutants of the surface water.

2. The primary source of sediment in surface water is stream bank erosion. Streambanks have been degraded by livestock overgrazing. This erosion has been accelerated by peak flows following runoff from storms, spring thaws, irrigation waste water, return flows and headcutting in the upper reaches of Long Pine Creek.

3. A secondary source of sediment in surface water is upland erosion; primarily from irrigation runoff and storm events.

4. Bacterial contamination of Bone Creek is a potential surface water quality concern. Swimming is not encouraged at the Keller Park State Recreation Area on Bone Creek due to high bacterial levels. Possible sources of contamination include runoff from feedlots after storm events and discharge from the Ainsworth sewage treatment plant.

Monitoring Objectives: The following monitoring objectives were formulated to facilitate implementation of the post-implementation surface water quality monitoring.

1. To determine if a Primary Contact Recreation use is attainable on the lower reaches of Bone Creek based on the physical conditions and current public utilization of the stream.

2. To determine the frequency of water quality criteria violations and the level at which the appropriate beneficial uses are supported in streams within the project area.

3. To determine at what level salmonid spawning is currently supported in Long Pine and lower Bone Creeks based embryo survival in artificial redds.

4. To determine if the macroinvertebrate population (i.e., taxa present, frequency of occurrence, number of individuals, diversity and pollution tolerance) in Long Pine and Bone Creeks has significantly changed from pre-implementation conditions due to the implementation of BMPs.

5. To determine if the fishery population (i.e. taxa present, frequency of occurrence, diversity, and pollution tolerance) in Long Pine Creek, Bone Creek and Sand Draw has significantly changed from pre-implementation conditions due to the implementation of BMPs.

6. To determine if the salmonid population (i.e., standing crop, size class composition, and condition factors) of Long Pine Creek has improved from pre-implementation levels due to the implementation of BMPs.

7. To determine if the project implemented by the MNNRD to control headcutting in the upper reaches of Long Pine Creek is effective in reducing sediment delivery from this source.

8. To determine the combined effect of implementing BMPs (cedar revetments, other streambank stabilization measures, and control of headcutting) on fishery habitat and sediment delivery in upper Long Pine Creek.

9. To determine the change in trends in the suspended solids, substrate composition, and bacterial levels in Long Pine Creek due to the implementation of BMPs and feedlot controls.

10. To determine if summer water temperatures and instream habitat still restrict the cold water fisheries potential in the lower reaches of Long Pine Creek.

11. To determine the change in trends in suspended solids, substrate composition, bacteria, nutrients, organic waste (i.e. Biochemical Oxygen Demand, Chemical Oxygen Demand and Total Organic Carbon), and water temperature in Bone Creek due to the impementation of BMPs and feedlot controls.

12. To determine the change in trends in suspended solids, substrate composition, and water temperature in Sand Draw due to the implementation of BMPs.

13. To determine if there is any change in ambient surface water quality trends from pre-implementation conditions in Long Pine Creek, Bone Creek, Sand Draw, and Willow Creek.

Monitoring Locations: The location of the post-implementation monitoring sites will be identical to the location of sites monitored during the pre-implementation baseline study (Figure 6-1). Additional monitoring sites may be established to: (1) to determine if a recreational use is attainable on lower Bone Creek and (2) evaluate salmonid embryo survival in artificial redds located in Long Pine and lower Bone Creeks.

A recreational use attainability study will be conducted on lower Bone Creek in the vicinity of the Keller Park State Recreation Area. Survey sites will be located on lower Bone Creek to characterize the stream conditions that will be utilized to assess recreational use attainability.

Artificial redds will be placed in Long Pine and lower Bone Creeks to evaluate the degree to which salmonid spawning is supported. Artificial redds will be placed in Long Pine Creek in the vicinity of sites LP1, LP5, LP7, and LP8 and in lower Bone Creek at sites BN2 and BN3. Also, artificial redds will be placed in the Snake River in the area below the Snake River Falls (Cherry County) to serve as a reference (control) site.

Data Collection: The water quality variables, sampling methods and sampling frequency utilized in the post-implementation monitoring (Table 6-1)will be comparable, as appropriate, to those utilized during the pre-implementation baseline study.

Stream Morphology: Stream morphological characteristics of width, depth, velocity and gradient will be measured annually during the survey period. A minimum of five cross-sections will be measured for width at each location to obtain averages. At these same transects, depth and velocity will be measured at one foot intervals across the stream and all transects averaged for each site. Velocity measurements will be taken at 0.6 depth. Gradients will be measured through each study reach using a transit to measure water elevation change through a known length of stream. Observations of stream conditions will be recorded by field notes and photographs.

Ambient Parameters: Ambient parameters will be monitored on a monthly basis throughout the entire 3-year post-implementation monitoring period. Ambient parameters that will be measured include:

Stream Flow	Chloride
Water Temperature	Total Ammonia
Dissolved Oxygen	Nitrate-Nitrite
Conductivity	Total Phosphorus
Suspended Solids	Fecal Coliform Bacteria
pH	Fecal Streptococcus Bacteria
Biochemical Oxygen Demand	Dissolved Calcium
Chemical Oxygen Demand	Dissolved Sodium
Total Organic Carbon	Magnesium
Total Dissolved Solids	

Table 6-1. Summary of the Surface Water Quality Sample Types to be Collected During Post-Implementation Monitoring.

Monitoring Site	Stream Morphology	Ambient Parameters	Macroinvertebrates	Fish	Substrate Composition	Runoff	Rain Gauge	Thermograph	Artificial Redds	Use Attainability
Long Pine Creek										
LP1	X	X	X	X	X	X	X		X	
1A	X			X						
1B	X			X						
1C	X			X						
1F	X			X						
LP5	X	X	X	X	X				X	
LP7	X	X	X	X	X	X		X	X	
LP8	X	X	X	X	X	X	X	X	X	
Bone Creek										
BN0	X	X	X	X	X					
BN1	X	X		X	X	X				
BN2	X	X	X		X				X	X
BN3	X	X		X	X	X		X	X	X
Sand Draw										
SD1	X	X		X			X			
SD2	X	X		X	X	X				
Willow Creek										
W1	X	X								
Snake River	X								X	

All parameters except stream flow and water temperature will be determined from mid-stream grab samples. During the first year of monitoring, suspended solids will also be determined from composite samples obtained utilizing the DH-48 composite method. Suspended soilds values obtained from grab and composite samples will be compared to see if the same relationship established in the pre-implementation monitoring exists. If this relationship still exists, composite samples for suspended solids will only be collected on an intermittent basis after the first year. Parameters to be measured in the field include instantaneous flow (meter), pH (meter), water temperature (thermometer), conductivity (meter), and dissolved oxygen meter. Other parameters will be analyzed in NDEC's laboratory using procedures outlined in Standard Methods (APHA 1985).

Macroinvertebrate Community: Qualitative macroinvertebrate samples will be collected using multiplate Hester-Dendy type artificial substrate samplers. The samplers will consist of seven square tempered masonite (0.64 cm thick) plates, measuring 7.62 cm on a side, each separated by two 1.27 cm square masonite spacers (plates are held together by a large eye bolt). The samplers offer a surface area of approximately 948 cm2 for colonization. Two samplers will be set in the main channel and anchored to fence posts and/or cement blocks. Samplers will be allowed to colonize for at least four weeks, and be retrieved with the aid of a dip net with 1.0 mm meshing to minimize loss of organisms. Samplers will be scraped clean of all organisms and returned to the stream; samples will be composited at each site. The composited samples will be sieved and concentrated through a No. 30 standard sieve (595 um) and preserved in a jar with a 10% formalin solution.

Qualitative macroinvertebrate samples will also be collected utilizing the NDEC's rapid bioassessment procedures (NDEC 1991b).

Quantitative macroinvertebrate samples will also be collected from Long Pine Creek using a surber sampler consisting of a 0.0929 m2 (1ft2) sampling area. Three surber samples, of equal time duration, will be taken from the cross-section of a gravel rock riffle when present. The contents of the net, representing the three samples, will be deposited in a bucket, concentrated with a No. 30 sieve and preserved in a 10% formalin solution.

Macroinvertebrates will be processed in the laboratory by examination under a dissecting microscope with 7-30X magnification. When samples are large, random subsamples will be taken using a sample splitter. At least one-fourth of the sample will be analyzed when subsampling is necessary. Macroinvertebrates will be identified to the lowest practicable taxonomic level; usually genus or species.

Fish Population: Fish collections will be conducted by the NDEC and NGPC. Electrofishing methods will be used to obtain fish collections. Where necessary, blocknets will e used to reduce movement out of sample sites. All fish species and sizes will be collected. Where population estimates are to be made, a minimum of two sampling passes will be made. If the first pass capture rate is less than 50% compared to the second pass (dividing the first pass by the total catch), a third and possibly a fourth pass will be made. All fish collected will be identified to the species level, and weight and lengths will be taken on all salmonid species.

Substrate Composition: Substrate samples will be collected to describe the subsstrate composition at each site. Samples will be collected using a 5.1 cm (2 in) inside diameter core sampler insertd 10 to 15 cm into the substrate. Three core samples will be collected across the stream channel where visible rock and gravel appears greatest at the site. If no gravel is visible, samples will be randomly taken at equal distances across the stream. Substrate samples will be composited and preserved with formalin. In the laboratory, the samples will be air dried and sieved using a mechanical shaker. Samples will be separated into three fractions; gravel (2mm), sand (0.125 to 2.0 mm), and other (0.125mm); weighed and the percent total weight calculated.

Runoff Sampling: Runoff samples will be collected using automatic samplers with actuators. Samples will be collected contiuously once the sampler is actuated by an increase in water level. The samples will be collected as soon after the runoff event as possible, iced and shipped to the NDEC lab where they will be composited and analyzed.

Rainfall Monitoring: Rainfall intensity and amount will be monitored using recording rain gauges. Rainfall data will also be available from rainfall measurements taken at the Ainsworth Airport.

Continuous Temperature Recording: A continuous recording thermograph will be used to monitor daily water temperatures. Daily water temperatures will be monitored during the summer months when temperatures would most likely be limiting to cold-water fisheries.

Artificial Redds: Artificial redds will be utilized to assess salmonid spawning success in Long Pine and Bone Creeks. The placement of artificial redds instream will follow the protocol outlined by Burton et. al. (1990). Brown trout (Salmo trutta) eggs will be utilized in the fall and Rainbow trout (Oncorhynchus mykiss) eggs will be utilized in the spring. After an appropriate incubation period, the egg baskets will be removed and fry survival determined. Artificial redds will also be placed in the Snake River in the area below the Snake River Falls in Cherry County, Nebraska. The Snake River site will be used as a reference site to help evaluate the Long Pine and Bone Creek results. The Snake River, in the area of the Snake River Falls, possesses good salmonid populations and spawning habitat.

Use Attainability Survey: A use attainability survey will be conducted on lower Bone Creek to determine if a Class A recreational use is attainable on this reach of stream. The use attainability survey will be conducted in accordance with the procedures outlined by NDEC for use attainability studies (NDEC 1991c).

Data Reduction and Storage: Where possible, all collected data will be entered into the appropriate EPA data management system. Ambient water quality data will be stored on EPA's STORET system. Biological data, as appropriate, will be stored on EPA's BIOS system. Data that does not lend itself to storage in either of EPA's STORET or BIOS systems, will be maintained on a personal computer in LOTUS or dBASE IV files. Data stored in EPA data management systems will be statistically assessed by using SAS on EPA's mainframe or by down-loading to a PC and assessing it with applicable software. Data initially stored and managed on a PC will be statistically assessed with the appropriate software system.

Data Analysis and Assessment: Data analysis and assessment will be directed towards addressing the stated monitoring objectives. As such, it will essentialy fall under three categories: (1) recreational use attainability assessment of lower Bone Creek, (2) evaluation of existing water quality conditions, and (3) detecting BMP-attributable improvements in water quality.

Recreational Use Attainability Assessment: The NDEC has developed procedures for conducting use attainability studies (NDEC 1991c). These procedures will be used to evaluate lower Bone Creek.

Existing Water Quality Conditions: Existing water quality conditions will be evaluated in regard to maintenance of water quality criteria and support of designated existing beneficial uses. Beneficial uses and water quality criteria to protect those uses are defined in Nebraska's water quality standards (NDEC 1991a). Artificial redds will be used to evaluate support of salmonid spawning.

BMP Attributable Water Quality Improvements: Attempts will be made to detect improving trends in measured water quality-related variables, and link them to the implementation of BMPs. This type of evaluation will require rigorous statistical assessment. Several statistical tests and techniques will be explored and utilized in an attempt to detect any water quality improvements. Attention will be given to meeting any implied assumptions regarding the statistical techniques utilized. Accounting for the effects of climatic and hydrologic variability on measured water quality variables will be a critical concern.

One of the first steps that will be taken in assessing the collected information will be to graph the data and inspect it. By observing the graphed data insights can be gained into some of the factors that possibly had an affect on the observed water quality conditions. Seasonal cycles and general variability may be distinguished and identified from simple time series plots.

The statistical structure of the data will dictate the selection of trend analysis techniques. Possible techniques that will be utilized for trend analysis include:

*t-test/ANOVA - comparing means between years or monitoring periods;

*Time regression - testing the slope of a regression line of a water quality variable versus time;

*Frequency distribution - comparing distributions between years or monitoring periods, an evaluating probability of exceedance of water quality criteria;

*Flow/concentration regression - evaluating change in flow/water quality relationships following BMP application;

*Analysis of covariance - comparing treatments after adjustment for covariate effects, e.g., flow rainfall;

*Nonparametric techniques - less restrictive statistical assumptions are inferred in these techniques;

*Principal component analysis - multivariate technique for examining relationships among several quantitative variables.

As appropriate, the above statistical techniques will be used for exploratory and applied data analysis in an attempt to detect improving water quality trends attributable to BMP implementation.

In statistically assessing the collected data sets consideration will be given toward addressing three assumptions which are commonly violated by water quality data. These statistical assumptions are: independence of observations, constant variance, and normal distribution. Violation of independence, often by seasonality or autocorrelation, can be a serious problem; it can result in finding a trend where none exists or failing to identify a trend which does exist. Nonparametric tests for trends have been developed that account for seasonality and lack of independence. Some specific statistical techniques like Analysis of Covariance or nonparametric tests (seasonal Kendall) can be helpful in dealing with variability. Time series data can sometimes be aggregated (e.g., seasonal) to reduce autocorrelation and stabilize variance. Log transformations can often by used to normalize a data distribution for the application of parametric statistics.

Most trend detection techniques assume that changes in land use and water quality response are progressive and linear; that land treatment progressed chronologically and did not decline and that, in response, water quality changed consistently and permanently. These assumptions are unlikely to be true at all times. Thus, it is useful to focus on this variation in trying to identify linkages between land use and water quality. In relating land use to water quality, the following two points are of importance:

*The confounding ifluence of weather and season on NPS activity, and

*The issue of spatial variation must be considered (i.e., although the acres of a land use activity may remain relatively constant over time, individual fields in different proximity to targeted waters may rotate in and out of that activity).

Reporting: A final Long Pine RCWP report will be prepared which incorporates the results of the post-implementation surface water quality monitoring. The report should be completed nine months after the post-implementation surface water quality monitoring has been completed; tentatively April 1, 1996.

Ground Water Quality Monitoring — by Marty Link, NDEC

Irrigation, domestic, and stock wells have been sampled and tested for water quality each summer since 1982. Throughout this period, 67 different wells have been sampled (see Figure 6-3 for locations). Typically approximately 30 wells were sampled annually, usually in late in the irrigation season (August or early September. There was an attempt to re-sample the same wells annually. However, these efforts were often hampered by encountering wells no longer in use due to a variety of circumstances (land enrolled in the CRP

or setaside programs; rainy weather and irrigation rotation timing). Ultimately only 5 wells have been sampled 8 times, and no single well has been sampled either 9 or 10 times.

Irrigation wells are normally considered to be a better source of regional water quality information than domestic wells. Irrigation wells are usually located away from common point sources of contamination associated with domestic wells, such as septic tanks or sewer lines, barnyards and feedlots, and ag chemical storage and mixing areas. However, chemigation accidents are a potential point source problem at the irrigation well.

The average yearly nitrate-nitrogen concentration results from groups of wells may be misleading due to the different wells which were sampled each year. A better gauge of water quality trends is the examination of the nitrate-N levels in individual wells. Even with yearly sampling, a trend is not always clear or easily understood. Sometimes a large increase from one year to the next may indicate a point source of contamination. Wells 44 and 50 may be examples of this.

Pesticides have been analyzed for each year of testing. Over the years, 5 different pesticides have been detected. Half of these detections were the herbicide Atrazine, which is usually applied to corn. Other pesticides which have been detected include Treflan (trifluralin), Lasso (alachlor), Bladex (cyanide), and Dual (metolachlor).

Before sampling, the well was located and as much site-specific data as possible gathered by observation or from the well owner or person residing on site and using the well. This information was useful in evaluating the well's potential for being a point source of contamination. The tap closest to the well was located, opened, and allowed to run at full pressure for at least 15 minutes. This time period would usually provide a volume of water sufficient to purge both the pressure tank and three well casing volumes for domestic wells. Irrigation wells had been pumping for at least an hour before a sample was taken. Field conductivity and water temperature were measured, and sampling was initiated only after consecutive readings stabilized. The importance of these activities was to ensure the water sample was taken from the aquifer, and not water which has resided in the well casing or pressure tank for any length of time.

Samples were collected and preserved in the following manner:

One 1 liter plastic cubitainer was filled to the exclusion of air and left unpreserved for the analysis of major ions (biocarbonate, chloride, sulfate, sodium, magnesium, calcium, and potassium). One cubitainer was filled more than half full and preserved with 5 ml. concentrated sulfuric acid for nitrate-nitrogen analysis.

Pesticide samples were collected in sterilized 1000 ml. clear glass jars with teflon-lined plastic lids. At least one field blank set consisting of deionized water and duplicate set of samples were collected each day. These were preserved and handled in the same manner as the actual samples. All samples were preserved on ice during transport and refrigerated upon arrival at the NDEC laboratory.

The samples brought to the NDEC laboratory were analyzed using EPA approved methods as described in USEPA Methods for Chemical Analysis of Water and Wastes (EPA, 1983). The publication "Selected Analytical Methods Approved and Filed by USEPA, 1981, Supplement to the 15th Edition of Standards Methods for the Examination of Water and Wastes" was used in the analysis of irrigation well samples for pesticides.

Results of sampling were reported to LPRCWP, who in turn shared the individual water quality results with each well owner and/or operator. Implications of testing results were also discussed with individuals. (See Figure 6-3; see Table 6-2).

Groundwater samples will continue to be taken throughout the post-monitoring period.

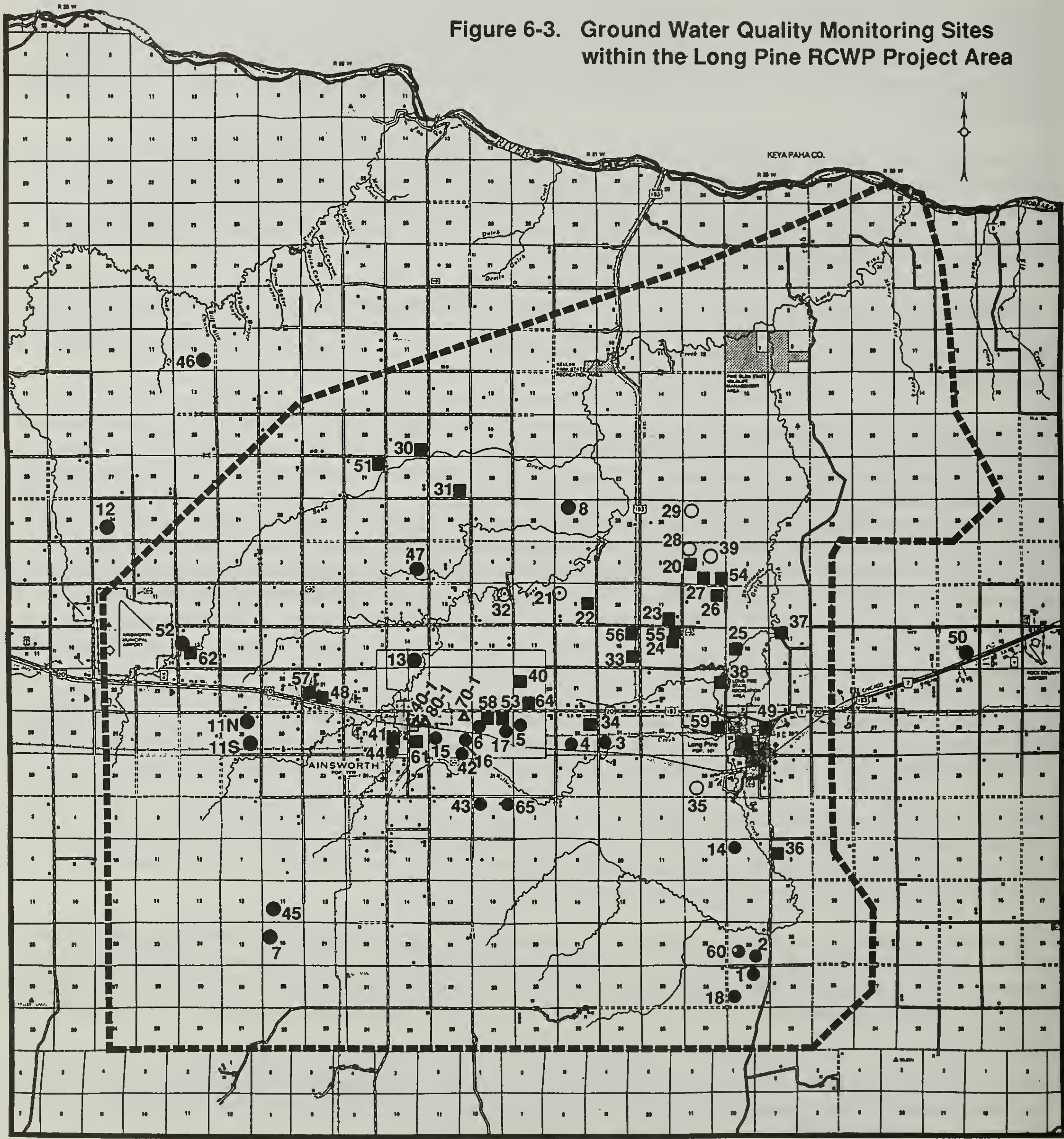


Figure 6-3. Ground Water Quality Monitoring Sites within the Long Pine RCWP Project Area

SCALE
0 1 2 3
miles

Location of Wells Not on Map
● 9 - T26N R22W Sec.9 SE
● 10 - T26N R22W Sec.8 SE
● 19 - T26N R22W Sec.8 NW

KEY
■ Domestic Well
● Irrigation Well
○ Stock Well
△ Municipal Well

24 & 24A at same location
40 & 40A at same location
20 & 63 at same location

Table 6-2
Summary of Statistics of Nitrate-N
Concentrations (mg/l) for Monitoring Wells
in the Long Pine RCWP
1982-1991

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
IRRIGATION & STOCK										
No. of Wells	12	12	15	18	9	7	5	11	10	5
Mean	1.9	2.2	3.3	5.7	5.3	6.0	13.7	9.01	6.56	8.58
Range	0.6-12.4	0.5-9.7	0.7-9.4	0.6-24.5	1.1-8.9	0.8-18	7.74-20.73	1.11-22.82	0.77-23.5	0.98-25.3
DOMESTIC										
No. of Wells	-	10	12	14	19	20	18	13	18	20
Mean	-	5.3	4.9	5.1	4.8	4.3	4.02	5.75	4.83	4.15
Range	-	1.3-9.7	0.4-20.0	0.7-15.7	1.2-14.3	0.4-12	0.37-18.05	1.33-15.98	0.39-17.9	0.58-18.1
MUNICIPAL										
No. of Wells	6	3			2					
Mean	4.8	7.2	-	-	1.6	-	-	-	-	
Range	1.1-10.3	6.7-8.0			1.4-1.8					
ALL WELLS										
MEAN	2.6	3.6	4.0	5.4	3.9	4.8	6.01	7.24	5.44	5.15

Results of Ground Water Sampling, 1982 - 1991

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti-cides ug/l	Total Phos. mg/l	TOC mg/l
1	LPGW01	I/82	6.7	113	0.83	<5.0	0.2	78	4.0	1.2	11.6			0.10	0.5
	(G-27016)	83	6.0	103	1.23	<5.0			4.4	0.9	11.1			0.22	0.4
	NE1/4 S30 T29N R20W	84	7.3	80	1.6	<5.0			4.2	1.4	12.1			0.23	0.4
2	LPGW02	I/82	6.7	113	0.6	<5.0	0.2	73.2	3.9	1.1	10.2			0.1	0.6
	(G-65168)	84	7.1	80	1.1	<5.0			4.0	1.2	11.4		0	0.24	0.6
	SE1/4 S19 T29N R21W														
3	LPGW03	I/82	6.8	146	0.92	0.7	0.3	102	4.9	1.8	16.4			0.02	0.8
	(G-53442)														
	SW1/4 S27 T30N R21W														
4	LPGW04	I/82	6.7	146	0.84	<0.02	0.2	97.6	4.0	1.6	13.6			0.02	0.6
	(G-60587) GRAVITY	85	7.6	122	0.9	<5.0			4.3	1.5	14.9		0.09 Tr	0.07	0.8
	SW1/4 S28 T30N R21W														
5	LPGW05	I/82	6.7	133	1.52	0.55	9.9	97.6	4.0	1.8	14.7			0.04	0.5
	(G-02655) PIVOT	83	6.1	124	1.04	<5.0			4.3	1.2	14.3			0.16	0.3
	NW1/4 S29 T30N R21W	84	7.0	180	0.7	<5.0			7.7	4.9	26.8			0.18	1.1
		85	7.3	255	11.5	<5.0			8.7	5.1	28.8		0.22 Tr	0.17	1
													0.10 Al		
													0.93 Bl		
		86	7.1	229	8.9	<5.0			7.5	4	22.9			0.19	1.3
		89	7.43	121	1.69	<1.0		49.90	4.8	2.2	14.9		nd	0.13	<1.0
		90	7.3	119	1.45	<1.0	<10	49.4	4.5	2.1	13.5	3.7	20.0 At	–	–

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti-cides ug/l	Total Phos. mg/l	TOC mg/l
6	LPGW06	I/82	6.8	326	12.4	6.16	0.26	102	7.3	4.99	31.04			0.007	0.93
	(G-55849) PIVOT	85	7.3	122	1.7	<5.0			4.6	1.8	14.9		0.07 Tr	0.12	1.1
	NW1/4 S30 T30N R21W												0.01 Al		
													0.02 Bl		
		86	7.1	218	7.7	<5.0			7.9	4.2	22.8			0.26	<1.0
		87	7.1	218	6.9	<5.0		60	6.6	3.9	25			0.21	1.2
		88	7.1	213	9.1	3.2		63	8	4.4	25.7		.118 At	0.21	1.5
		89	7.1	241	8.53	2.65		63.0	8.4	4.5	28.0		nd	0.14	1.02
		90	7.1	177	4.33	2.1	<10	53.8	6.9	3.5	18.9	4.2	nd	–	–
7	LPGW07	I/82	6.8	140	1.94	0.96	0.26	78.6	4.6	1.5	12.8			0.07	0.6
	(G-44627)	83	6.2	124	1.8	<5.0			5.0	1.0	12.8			0.28	1.3
	NW1/4 S20 T29N R22W														
8	LPGW08	I/82	6.7	266	0.53	0.69	0.99	185	11.3	3.5	25.7			0.02	0.6
	(G-61238) PIVOT	83	6.7	218	1.4	<5.0			11.0	3.2	26.4			0.02	1.1
	NW/4 S33 T31N R21W	84	7.5	180	0.7	<5.0			11.6	3.7	26.9		0	0.02	0.6
		85	7.7	224	0.6	<5.0			10.9	3.4	27		0.09 Tr	0.02	5
													0.04 Al		
													0.08 Bl		
9	LPGW09	I/82	6.8	156	0.89	0.69	0.33	108	5.1	1.6	16.3			0.04	0.7
	(G-39200) PIVOT														
	SE1/4 S9 T26N R22W														
10	LPGW10	I/82	6.6	226	0.59	0.02	0.07	83.4	4.9	1.1	11.6			0.08	0.7
	(G-42287) PIVOT	83		135	0.5	<5.0			5.2	1.1	18.2			0.08	0.1
	SE1/4 S8 T26N R22W	84	7.4	105	1.8	<5.0			5	1.4	15.4			0.16	0.7

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti- cides ug/l	Total Phos. mg/l	TOC mg/l
11S	LPGW11S	I/82	6.9	186	0.78	0.55	0.07	134	4.5	2.7	18			0.02	0.7
	(G-59927) PIVOT	87	7.8	156	0.81	<5.0		72	3.9	2.5	20			0.06	1.1
	SE1/4 S30 T30N R22W	90	7.62	160	0.77	<1	<10	7.35	4.8	2.9	20.2	3.9		–	–
		91	7.47	162	0.98	<1	<10	71.3	5.0	2.7	18.5	4.6	nd		
11N	LPGW11N	I/85	7.6	178	8.4	<5.0			6.4	3.6	21.6		0	0.2	1.2
	PIVOT	89	7.0	201	9.06	3.10		39.60	6.6	3.7	22.2		nd	0.16	<1.0
	NE S30 T30N R22W														
12	LPGW12	I/82	7	226	0.9	0.8	1	166	7	3.3	26			0.02	0.7
	(G-57092) PIVOT	84	7.5	170	1.3	<5.0			6.6	3.6	28.7		0	0.03	0.6
	SW1/4 S26 T31N R23W														
13	LPGW13	I/83	6.4	259	3.05	7			11.9	4.7	28.8			0.3	1.7
	(G-69232) GRAVITY	85	7.4	581	24.5	<5.0			33.5	16.8	85		0.02 Al	0.15	41.5
	SE1/4 S14 T30N R22W							240					0.05 Du		
													0.01 Bl		
													4.7 At		
		87	7.4	696	18	29			33	17	84			0.19	3
		88	7.5	760	20.61	35.4		277	40.6	18.5	92.9		1.480 A	0.23	4.34
		89	7.6	852	20.69	49.4		245.7	39.4	18.6	97.3		nd	0.18	3.12
		90	7.24	808	23.5	40	24.4	234.9	34.7	18.3	90.1	23.1	1.02 At	–	–
		91	7.19	840	25.3	37.4	27.3	247.6	34.5	20.7	89.2	23.2	nd		
14	LPGW14	I/83	5.9	155	3.43	<5.0			6.1	1.9	14.9			0.28	0.9
	(G-32244)														
	NW1/4 S7 T29N R21W														

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti- cides ug/l	Total Phos. mg/l	TOC mg/l
15	LPGW15	I/83	6.2	181	4.66	<5.0			6.8	3	21.9			0.21	2.4
	(G-56268) GRAVITY	84	7.1	160	6.9	<5.0			7.1	3.8	23		0	0.19	1.4
	SW1/4 S25 T30N R22W	85	7.2	255	8.5	<5.0			8.6	4.8	30.6		0.02 Al	0.16	4.6
													0.01 Bl		
		86	7.2	223	8.5	<5.0			7.6	4	23			0.23	<1.0
		87	7.4	201	5.7	<5.0		58	5.9	3.1	22			0.19	<1.0
		88	7.21	202	7.82	2.4		59	7.3	3.8	26.2		nd	0.2	1.74
		89	7.1	221	9.02	3.09		58.3	7.5	4.0	26.1		nd	0.18	<1.0
		90	6.9	283	10.7	3.9	10.8	76.3	9.2	5.3	32.4	5.8	nd	–	–
16	LPGW16	I/83	6.1	187	6.46	<5.0			7.1	3.1	20.9			0.21	0.9
	(G-20244) GRAVITY	85	7	163	4.3	9.9			6.3	2.9	20.3		0	0.15	3.6
	SE1/4 S25 T30N R22W	86	7.4	161	5.8	<5.0			5.8	2.9	16.1			0.24	<1.0
		89	7.2	179	4.95	2.9		49.9	6.3	3.2	20.8		nd	0.15	<1.0
		91	7.00	184	5.81	2.96	<10	48.5	6.0	3.1	18.7	4.7	1.49 At		
17	LPGW17	I/83	6.1	124	1.1	<5.0			4.3	1.3	14.9			0.1	0.3
	(G-15078) PIVOT	84	7	100	1.8	<5.0			4.2	1.9	15			0.1	0.4
	NE1/4 S30 T30N R21W	85	7.3	122	1.2	<5.0			4.4	1.8	16		0	0.08	4.9
		86	7.4	116	1.1	<5.0			4.3	1.8	13.4			0.15	<1.0
		87	7.4	120	1	<5.0		57	3.7	1.7	15			0.09	<1.0
		88	7.7	401	7.74	1.8		183	17.7	8.1	57.7		nd	0.12	0.98
		89	7.8	123	1.11	<1.0		54.7	4.6	2.2	15.7		nd	0.09	<1.0
		90	7	123	1.57	<1.0	<10	47.2	4.6	2.3	13.6	3.9	nd	–	–
18	LPGW18	I/83	5.8	103	1.0	<5.0			4.4	0.8	11.5			0.27	0.48
	(G-65112)	85	7.2	100	1.1	<5.0			4.7	1.2	11.9		0	0.2	2.8
	SW1/4 S30 T29N R20W														

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2.	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti-cides ug/l	Total Phos. mg/l	TOC mg/l
19	LPGW19	I/83	6.5	135	0.8	<5.0			5.3	1.1	17.1			0.22	0.7
	(G-50611) PIVOT	84	7.7	105	0.4	<5.0			4.7	1.5	18.2			0.07	0.6
	NW1/4 S8 T26N R22W														
20	LPGW20	D/83	6.6	299	9.65	<5.0			7.9	4.5	37.4			0.1	1.3
	SW1/4 S1 T30N R21W	85	7.7	270	9.1	<5.0			8.2	4.3	36.9		0	0.04	5.1
	well replaced 86-87	86	7.9	299	9	<5.0			7.5	4.5	37.7			0.1	1.4
	new well = #63														
21	LPGW21	S/83	6.3	293	7.45	<5.0			10	5.4	37.4			0.2	1.6
	SW1/4 S9 T30N R21W	87	7.2	183	2.4	<5.0		69	6.7	3.1	22			0.18	<1.0
		88	7.3	184	2.93	1.4		74	7.5	3.6	23.4		nd	0.18	1.35
		90	7.2	235	3.23	2	<10	90	8	4.6	28.1	5.8	nd	--	--
		91	7.02	244	3.19	2.06	<10	93.4	7.6	4.6	27.5	6.1	NT		
22	LPGW22	D/83	6.8	440	5.9	<5.0			16.2	13.2	62			0.1	2.2
	SE1/4 S9 T30N R21W	87	7.6	183	3.2	<5.0		100	8.8	4.5	32			0.14	1.3
		89	7.3	285	4.06	1.74		115.9	10.4	5.0	37.7		nd	0.12	1.09
		90	7.1	280	3.95	2.2	10.4	108.6	9.4	5.6	34.3	7.1	nd	--	--
		91	7.14	297	4.26	2.51	<10	113.3	8.5	5.8	34.4	7.2	NT		
23	LPGW23	D/83	7.1	564	5.2	<5.0			23.1	14.1	86.2			0.1	2.9
	SE1/4 S11 T30N R21W	85	7.6	561	7.7	<5.0			22.5	10.2	69.3		0	0.05	16.8
		86	7.8	525	7.5	<5.0			19.4	9.7	66.4		2.34 At	0.09	2.3
		87	7.7	514	8.1	<5.0		230	21	5.7	75			0.06	1.6
		89	7.8	505	8.82	1.49		216.2	22.4	9.6	68.6		nd	0.06	1.57
		90	7.6	464	7.71	2.1	12.7	198.6	20.5	9	60.1	8.8	nd	--	--
		91	7.55	505	8.25	2.03	12.5	214.6	20.8	10.1	61.6	9.5	NT		

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti-cides ug/l	Total Phos. mg/l	TOC mg/l
24	LPGW24	D/83	7.8	564	7.8	<5.0			17.6	13.1	74.4			0.1	3.9
	NE1/4 S14 T30N R21W	87	7.6	519	6.4	7.7		220	19	9.5	76			0.07	3.3
		88	7.6	442	4.79	8.8		207	19	9.7	69.7		nd	0.08	3.17
		89	7.7	501	7.86	6.14		202.7	21.3	9.8	68.2		nd	0.07	2.25
		90	7.4	457	5.69	6.7	22.6	185.5	18.6	9	59.2	9.3	nd	–	–
24A	LPGW24A	D/91	7.47	359	4.10	4.79	11.3	146.4	11.0	6.0	46.3	7.2	NT		
	NE1/4 S14 T30N R21W														
	new well drilled 7-91														
25	LPGW25	D/83	7	197	1.27	<5.0			4.6	3	23			0.02	0.8
	SW1/4 S18 T30N R20W	85		208	1.5	<5.0			6.8	2.9	23.7		0	0.03	7
		86	7.9	205	1.4	<5.0			6.3	3.3	25.5			0.04	<1.0
		90	7.8	171	0.64	<1	10	81.2	6.1	3.2	21	4.2	nd	–	–
		91	7.55	171	0.58	<1	<10	79.4	5.7	3.0	19.9	4.2	nd		
26	LPGW26	D/83	7.2	237	2.36	<5.0			2.8	4.5	31			0.1	1
	NE1/4 S12 T30N R21W														
27	LPGW27	D/83	7.2	350	6.4	<5.0			10.8	6.7	46			0.1	1.5
	SW1/4 S1 T30N R21W	85	7.7	374	7.8	<5.0			10.3	5.2	46.6		0	0.03	11.9
		86	7.8	352	3.9	<5.0			8.2	5.3	44.2			0.07	<1.0
		87	7.8	335	5.2	<5.0		140	9.9	6.6	60			0.05	1.4
		88	7.8	299	4.99	3.8		130	10.6	5.3	46.2		nd	0.05	1.02
		89	7.7	420	10.54	12.4		130.1	12.7	6.3	58.0		nd	0.06	1.29
		90	7.5	365	5.06	5.9	15	141.6	10.6	6.1	50	6.4	nd	–	–
		91	7.72	355	6.06	4.54	12.3	131.5	10.7	5.5	44.6	6.6	NT		
28	LPGW28	S/83	7.2	237	2.93	<5.0			32.3	3.9	7.6			0.02	1.2
	NW1/4 S1 T30N R21W														

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti- cides ug/l	Total Phos. mg/l	TOC mg/l
29	LPGW29	S/83	7.2	237	3.43	<5.0			4.3	3	27.5			0.2	1
	NW1/4 S36 T31N R21W														
30	LPGW30	D/84	7.3	137	1.8	<5.0			5	2.5	19.4		0	0.03	0.5
	NW1/4 S20 T30N R21W	85	7.1	146	1.5	<5.0			5.8	1.6	17.2		0	0.05	2.8
		86	7.7	147	1.7	<5.0			4.6	2.3	16.6			0.06	<1.0
		87	7.7	154	1.6	<5.0		91	4.9	1.8	21			0.06	<1.0
		88	7.68	146	1.71	<1.0		81	5.1	2.6	18.1		nd	0.05	0.63
		89	7.6	152	1.74	<1.0		65.8	5.1	2.6	19.3		nd	0.11	<1.0
		90	7.3	155	2.04	<1.0	<10	65.8	4.9	2.7	18.2	4.7	nd	–	–
		91	7.41	161	1.87	<1	<10	67.2	4.9	2.6	18.1	4.8	NT		
31	LPGW31	D/84	7.7	360	2.03	<5.0			21.1	7.5	53.4		0	0.05	1.2
	SE1/4 S25 T31N R22W	85	7.3	281	1.2	<5.0			12.4	4.8	40.4		0	0.08	14.8
		86	7.5	368	1.7	<5.0			14	5.9	43.9			0.08	1.5
		87	7.7	346	1.3	<5.0		170	18	5.8	46			0.07	1.2
		88	7.8	319	1.33	1.4		169	17.3	5.8	45.3		nd	0.07	2.24
		89	7.6	336	1.33	5.49		160.9	17.5	5.6	44.0		* lost	0.07	1.02
		90	7.5	349	1.5	2.2	10.9	164.6	17.8	5.8	42.2	7.7	nd	–	–
		91	7.42	339	1.56	1.89	<10	157.4	15.4	5.9	39.9	8.2	NT		
32	LPGW32	S/84	7.4	90	0.8	<5.0			4.9	1.9	14.2		0	0.13	0.4
	NE1/4 S7 T30N R21W	85	7	135	0.7	<5.0			5.3	1.2	12.3		0	0.14	4

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti-cides ug/l	Total Phos. mg/l	TOC mg/l
33	LPGW33	D/84	7.5	620	20	14			47	19.3	93.8		0	0.15	3.2
	SE1/4 S15 T30N R21W	85		665	15.7	<5.0			29.9	12	68.2		0.08 Al 7.2 At	0.1	18.8
		86	7.7	530	14.3	<5.0			14.9	10.8	65.4		3.9 At	0.2	1.1
		87	7.5	560	12	<5.0		220	27	12	76		10.05 A .068 D	0.17	2.3
		88	7.43	572	18.05	4.3		242	20.5	12.6	87.7		nd	0.17	3.24
		89	7.3	657	15.98	4.32		245.2	19.7	13.8	94.5		nd	0.14	2.29
		90	7.2	672	17.9	4.9	27.7	250.2	23.1	13.8	88.8	13.1	3.14 At	–	–
		91	7.18	661	18.1	4.10	25.6	243.5	21.3	14.4	83.8	12.5	NT		
34	LPGW34	D/84	6.8	205	7.5	<5.0			7.5	9.2	31.5		0		2.6
	NE1/4 S28 T30N R21W	85	6.5	250	9	8.4			8.3	5.1	27.3		0	0.08	5.4
		87	6.8	265	6.4	<5.0		79	7.2	4.8	34			0.12	2.2
		88	6.94	246	6.7	2.9		79	8	4.9	30.3		.364 At	0.15	1.99
		90	6.6	252	6.81	3.9	13	76.8	7.5	4.8	28.8	6.7	nd	–	–
		91	6.67	260	7.45	4.34	11.9	73.9	7.6	4.8	27.8	7.2	NT		
35	LPGW35 SW1/4 S36 T30N R21W	S/84	7	95	3.9	<5.0			4.5	1.5	12.1		0		0.6
36	LPGW36	D/84	7.1	110	3.4	<5.0			5.1	2.6	19.3		0		1.4
	NW1/4 S8 T29N R20W	85	6.8	152	3.9	<5.0			6.3	2.2	20.1		0	0.16	6.3
		86	7.2	145	2.2	<5.0			5.2	2.5	16.1			0.16	1.1
		87	8	139	0.37	<5.0		65	3.8	2	19			0.02	<1.0
		88	8.1	134	0.37	<1.0		65	4.4	2.3	18.6		nd	<0.02	0.28
		90	7.8	140	0.39	<1.0	<10	67	4.1	2.5	17.7	3.9	nd	–	–
		91	7.66	142	0.38	<1	<10	65.7	4.2	2.2	16.9	4.0	NT		

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti-cides ug/l	Total Phos. mg/l	TOC mg/l
37	LPGW37	D/84	7.6	130	2.5	<5.0			5.2	3.3	23.3		0		0.6
	NW1/4 S17 T30N R20W	85	7.5	152	1	<5.0			4.7	2.3	19.2		0	0.02	2.5
	(summer camp)	86	7.6	153	1.2	<5.0			4.8	2.8	19.7			0.03	<1.0
		87	7.8	156	0.89	<5.0		74	4.9	2.5	21			0.03	<1.0
		88	7.94	154	0.98	<1.0		73	4.9	2.8	20.7		nd	<0.02	0.49
		91	7.54	160	0.90	<1	<10	72.3	4.6	2.7	18.8	4.2	NT		
38	LPGW38	D/84	7.3	130	0.8	<5.0			5.2	2.6	21			0	0.7
	NE1/4 S24 T30N R21W	85	7.3	161	0.7	<5.0			6.3	1.7	18.4		0	0.06	4.6
39	LPGW39	S/84	7.6	190	3	<5.0			7.4	4	36.8				0.8
	NE1/4 S1 T30N R21W														
40	LPGW40	D/84	7.2	235	12.7	<5.0			8.4	6.8	36.6		0		1.2
	NW1/4 S20 T30N R21W	85	6.8	312	14.4	<5.0			9.3	6.2	33.8		0	0.1	1.1
	(new, deeper well	86	7.1	315	11.9	5			8.6	5.7	35		2.4 At	0.18	1.1
	put in in 88-see 40A)	87	7	217	6.1	21		81	7.1	3.2	24			0.18	1.4
40A	LPGW40A	88	7.2	146	1.99	<1.0		43	5.7	1.9	11.1		nd	0.28	0.75
	NW1/4 S20 T30N R21W	89	7.2	116	1.78	<1.0		46.2	5.8	1.9	12.1		nd	0.21	<1.0
		90	6.93	121	2.07	<1.0	<10	49.4	5.5	1.7	11.7	4.5	nd	–	–
		91	7.00	129	2.77	1.11	<10	44.8	5.5	2.0	12.1	4.8	NT		
41	LPGW41	D/84	7.5	160	0.4	<5.0			5.5	4.1	28.6				0.3
	SW1/4 S26 T30N R22W	85	7	281	7	<5.0			9.8	4.7	29.6		0	0.12	3
	(city water)	86	7.4	231	3	<5.0			7.9	4.1	27.2			0.36	<1.0
42	LPGW42	I/84	7	160	5.6	<5.0			6.9	3.9	26.3				1.1
	(G-64135)														
	SE1/4 S25 T30N R22W														

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti-cides ug/l	Total Phos. mg/l	TOC mg/l
43	LPGW43	I/84	7.1	105	3.7	<5.0			5.8	2.4	19.3				0.6
	(G-47232) PIVOT	85	7	116	2.2	<5.0			5.4	1.7	14.1		0	0.2	1.4
	NW1/4 S6 T29N R21W	90	6.8	149	3.89	1.7	<10	47.2	6.1	2.8	15.8	4.2	nd	--	--
44	LPGW44	I/84	7.1	240	9.4	<5.0			11	6.5	35.2		0		1
	(G-20242) GRAVITY	85	7.3	301	9.9	<5.0			11.6	6.2	38.3		0	0.1	6.7
	SW1/4 S26 T30N R22W	86	7.3	226	6.2	<5.0			8.9	4.1	24.5			0.19	<1.0
		87	7.4	274	6.9	<5.0		9.3	11	4.6	33			0.14	<1.0
		89	7.4	380	13.35	1.50		132.8	13.6	7.6	49.1		nd	0.13	1.22
		91	7.08	351	9.31	1.75	<10	125.4	12.5	7.0	38.9	8.6	nd		
45	LPGW45	I/84	7.1	90	1.4	<5.0			4.6	1.4	12.5		0		0.8
	(G-44628) PIVOT	85	7	92	1.2	<5.0			4.8	1	10.3		0	0.2	2.3
	SW1/4 S17 T29N R22W														
46	*LPGW46	I/84	7.3	190	2.4	<5.0			7.1	4.1	32		0		0.6
	(G-41598) PIVOT														
	SE1/4 S12 T31N R23W														
47	LPGW47	I/84	7.4	150	1.2	<5.0			7.8	2.9	24		0	0.5	5.4
	(G-42351) PIVOT														
	SE1/4 S2 T30N R22W														
48	LPGW48	D/85	7	182	3.2	<5.0			7.8	3.1	17.8		0	0.2	5.9
	SW1/4 S21 T30N R22W	86	7.6	263	6.1	<5.0			10.3	5.1	26.4			0.34	1.2
49	LPGW49	D/85	7.9	2.8	3.7	<5.0			6.6	2.2	22.8		0	0.02	3.6
	NE1/4 S30 T30N R20W														

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti- cides ug/l	Total Phos. mg/l	TOC mg/l
50	*LPGW50	I/85	7.6	166	3	<5.0			6.6	2.8	21.8		0	0.03	3.8
	(G-48587) PIVOT	86	7.8	179	6	<5.0			5.8	3	22.4			0.05	
	SE1/4 S13 T30N R20W	87	7.6	181	2.6	<5.0		73	4	2.1	18			0.03	1.4
		89	6.8	379	22.82	6.39		42.6	8.7	6.5	45.2		nd	0.09	1.92
		90	7.2	277	12.9	4.3	10.7	10.7	6.8	4.8	33.1	5	nd	–	–
51	LPGW51	D/85	7.4	218	1.2	<5.0			8.9	3	23.5		0	0.07	1.2
	NE1/4 S27 T31N R22W														
52	LPGW52	I/85	7.5	275	4.4	<5.0			8	5.1	33.7		0.02 Al	0.11	7.4
	(G-02628) GRAVITY												0.02 Bl		
	NW1/4 S13 T30N R23W	86	7.2	210	2.1	<5.0			6.8	3.7	23.4			0.15	1.3
		89	7.3	285	4.78	1.16		112	8.4	5.7	36.2		0.215 A	0.11	1.33
		90	6.8	251	3.21	1.3	<10	101	6.7	5.2	30.6	8.6	nd	–	–
		91	7.18	183	1.52	1.14	<10	75.3	5.2	3.0	21.9	5.1	nd		
53	LPGW53	D/86	7.1	175	6.9	<5.0			6.9	3.2	19			0.2	1.1
	NW1/4 S30 T30N R21W	87	7	181	5.5	<5.0		51	5.8	2.7	23			0.24	<1.0
		88	7.2	121	2.97	1.1		43	5.6	2.2	13.3		.138 At	0.24	0.82
		89	7.1	196	7.56	1.74		53.3	7.2	3.6	23.1		nd	0.19	<1.0
		90	7.1	176	4.47	3.2	<10	55.4	6.6	3.2	19.4	4.7	nd	–	–
		91	6.93	139	2.34	2.04	<10	48.8	5.6	2.3	13.8	4.2	NT		
54	LPGW54	D/86	7.8	194	1.2	<5.0			6	3.2	24.5			0.06	<1.0
	SE1/4 S1 T30N R21W	87	7.8	192	1	<5.0		89	4.9	3	28			0.05	<1.0
		88	7.8	206	1.32	1.3		95	6.6	3.7	19.5		nd	0.11	0.98
		89	7.8	208	1.61	1.27		93.2	6.5	3.6	29.1		nd	0.06	<1.0
		90	7.56	217	1.37	1.8	<10	101	6.3	3.8	28.8	4.6	nd	–	–
		91	7.54	226	1.28	2.14	<10	100.1	6.2	3.8	28.3	4.8	NT		

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti- cides ug/l	Total Phos. mg/l	TOC mg/l
55	LPGW55	D/86	7.8	220	1.8	<5.0			6.9	4	27.2			0.06	1.3
	NE1/4 S14 T30N R21W	87	7.9	220	1.6	<5.0		100	6.3	2.8	32			0.05	<1.0
		88	7.9	231	2.22	2.3		106	7	4.4	32.8		nd	0.04	1.57
		89	7.9	254	2.52	2.26		106.8	7.5	4.7	35.6		0.152 A	0.05	1.35
		90	7.6	293	2.77	3.7	<10	124	7.7	5.8	39.6	5.4	nd	–	–
		91	7.78	293	2.65	3.65	<10	123.0	7.4	5.6	37.5	5.8	NT		
56	LPGW56	D/86	7.9	352	6.2	<5.0			9.5	5.1	47.9			0.07	1.5
	NE1/4 S15 T30N R21W	87	7.4	350	5.8	<5.0		150	8.8	5.4	54			0.09	1.1
		88	7.8	370	6.97	2.5		160	9.9	6.1	60.3		nd	0.08	1.9
		89	7.8	426	8.52	1.96		166.9	10.2	6.6	66.1		nd	0.06	1.02
		90	7.5	439	8.62	2.6	16.5	173.4	9.9	6.9	63.2	7.3	nd	–	–
		91	7.64	466	9.62	2.87	15.2	180.6	10.1	7.4	65.2	7.8	NT		
57	LPGW57 NW1/4, SW1/4 S21 T30N R22W	D/86	7.3	181	4.3	<5.0			5.7	3.4	19.9			0.25	<1.0
58	LPGW58 NW1/4, NW1/4 S30 T30N R21W	D/86	7.2	158	4.9	<5.0			5.9	2.8	17			0.26	<1.0
59	LPGW59 NE1/4 S25 T30N R21W	D/86	7.2	118	1.8	<5.0			6.3	1.6	11.9			0.24	<1.0
60	LPGW60 (G-34328?) PIVOT SW1/4 S19 T29N R20W	I/86	7.8	149	1.5	<5.0			5.9	2.4	17.3			0.03	<1.0

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti- cides ug/l	Total Phos. mg/l	TOC mg/l
61	LPGW61 NW1/4,	D/87	7.4	213	5.6	<5.0		69	8.1	3.4	26			0.21	<1.0
	SE1/4 S26 T30N R22W	88	7.2	190	6.31	1.7		63	7.6	3.5	22.4		.196 At	0.22	0.97
		90	7.1	302	11.8	3	<10	86.2	9.8	5.7	35.4	6.1	nd	–	–
		91	7.00	251	8.03	2.32	<10	79.1	9.9	4.3	26.1	5.6	NT		
62	LPGW62 SW1/4,	D/87	7.1	301	2.3	<5.0		140	6.1	6.7	42			0.21	3.7
	NW1/4 S13 T30N R23W	88	7.2	374	4.52	8.4		194	7.6	9	53.3		.345 At	0.13	3.06
		90	7.2	172	1.21	1	<10	74.6	4.9	3.2	21.9	4.5	nd	–	–
		91	7.19	180	1.26	<1	<10	76.8	5.0	3.0	21.7	4.9	NT		
63	LPGW63 NW1/4,	D/87	7.6	227	1.4	<5.0		87	6.6	3.6	32			0.07	1
	SW1/4 S1 T30N R21W	88	7.7	225	1.93	2.6		105	6.8	4.1	31.9		nd	0.07	1.08
	(see #20)	89	7.5	250	2.38	3.1		105.9	7.4	4.4	35.5		nd	0.07	<1.0
		90	7.4	287	2.85	4.8	<10	121.8	7.6	5.3	38.6	5.7	nd	–	–
		91	7.49	305	3.25	5.35	<10	122.6	7.8	5.4	38.3	6.0	NT		
64	LPGW64 SW1/4, SW1/4 S20 R30N R21W	D/87	6.6	230	9.8	<5.0		53	5	4	24			0.22	1.1
65	LPGW65 GRAVITY NE1/4 S6 T29N R21W	I/89	7.22	129	3.09	<1.0		44.3	6.1	2.0	14.0		nd	0.21	<1.0

Map Code no.	NDEC Station No. (well reg. no.) location	Type/ year	month	pH *1	Cond. umhos *2	NO3 + NO2 as mg/l	Cl mg/l	SO4 mg/l *3	Alk. mg/l *4	Na mg/l	Mg mg/l	Ca mg/l	K mg/l *5	Pesti- cides ug/l	Total Phos. mg/l	TOC mg/l
40-1	40-1 HEALTH	M/82	9	6.9		5.3	0			12		26				
	(G-32396)	84	2	7.2		5.5	4			11		26				
	AINSWORTH															
	NE1/4 S26 T30N R22W															
70-1	70-1 HEALTH	M/82	9	7		10.3	4			14		38				
	(G-32393)	84	2	7.7		8.5	0			12		24				
	AINSWORTH															
	NE1/4 S25 T30N R22W															
80-1	80-1 HEALTH	M/82	9	7.5		5.4	2			12		27				
	(G-32396)	84	2	7.6		0.2	0			8		43				
	AINSWORTH	86	1			1.8										
	NE1/4 S26 T30N R22W															

NOTES:

*1 Measured in lab, standard units
*2 Measured in lab
*3 Sulfate tested for in 1982, 1990, & 1991
*4 Alkalinity as $CaCO_3$, except in 1982, when reported as bicarbonate ($HCO_3=$)
*5 Potasium tested for in 1990 & 1991
* lost = sample jar broke in transit

At = Atrazine
Al = Alachor
Bl = Bladex
Du = Dual
Tr = Treflan
nd = not detected
NT = Not Tested (1991)

Types of Wells
I = Irrigation
D = Domestic
S = Stock
M = Municipal

year	month sampled
82	Aug
83	Aug
84	Jul
85	Jul
86	Jul
87	Aug
88	Aug
89	Aug
90	Aug
91	Aug

Land Treatment — Methods of tracking land treatment for the objective of linking land treatment data with water quality monitoring data.

Although plans for water quality monitoring were extensive, there were no procedures established for the collection of land treatment data. Subbasins were not identified or addressed throughout implementation of the project (except in relation to the pre-monitoring baseline study by NDEC).

Consequently, no land treatment data existed that could be related to pre- and post-monitoring studies. In order to obtain this important data, it was necessary to research 10 years of ASCS and SCS files. This was time consuming and tedious. "Acres Served" and "Units Applied" data are only listed in CRES forms filled out by SCS.

Data was collected in the form of an audit. Every contract file at ASCS was reviewed. This could not have been accomplished without the assistance of Cathy Hansen, the ASCS program assistant. Every cost-share, noncost-share, modified or cancelled item was documented.
During this process, many inconsistencies in data reporting were discovered especially in reagrd to "acres served" and "units applied." (See Chapter 3-Implementation Results-Critical Area Treatment). With the help of SCS technicians, some of the data was revised (for report purposes only) in order to provide a continuity in data reporting.

In order to report data by subbasin, the subbasin lines were delineated on a large aerial photo of the watershed. Critical acres were then identified by producer. Practices were identified by location. Data was then sorted according to subbasin areas for many of the charts in this report. For procedures for the permanent documentation of critical acres, subbasins etc. see Chapter 3 - Implementation Results-Critical Area Definition. For procedures for a data log to establish documentation of cost-share and technical data see Chapter 3 - Findings and Recommendations-5.

GLOSSARY - Abbreviations, Terms

Acres Served	Unit Reported by the SCS for each practice installed reflecting the number of acres benefitted by the installation of the practice.
ACP.....................	Agricultural Conservation Program-USDA
ACR.....................	Acreage Conservation Reserve - Cropland set-aside requirement for Feed Grain Program participation.
AID.....................	Ainsworth Irrigation District
ARS.....................	Agricultural Research Service-USDA
ASCS....................	Agricultural Stabilization and Conservation Service-USDA
BMP.....................	Best Management Practice
BMP Systems.............	Combinations of BMPs employed to achieve a specific goal.
BNO, BN1, BN2, BN3.......	Water Quality Monitoring Stations
CAT.....................	Critical Area Treatment for roadside erosion
CES.....................	Cooperative Extension Service
COC.....................	ASCS County Committee
Cost-Share..............	Reimbursement for a portion of the cost of BMP implementation.
CRES Form...............	Conservation Reporting and Evaluation System-SCS form for reporting technical information on BMPs installed.
Critical Area...........	Severely eroded area that requires special management - the area targeted for treatment.
CRP.....................	Conservation Reserve Program-USDA
DTP.....................	Dairy Termination Program-USDA
EPA.....................	Environmental Protection Agency

ERS...................... Economic Research Service-USDA

ESCS..................... Economic Statistics & Cooperative Service

F&R...................... Findings and Recommendations

FSA...................... Food Security Act of 1985

FmHA..................... Farmers Home Administration-USDA

Gabion................... Grade Stabilization Structure-'drop structure'

HEL...................... Highly Erodible Land

I&E...................... Information and Education

IPM...................... Integrated Pest Management

LCC...................... Local Coordinating Committee

LP1, LP5, LP7, LP8....... Water Quality Monitoring Stations

LP Landowners............ Long Pine Landowners Association

LPRCWP................... Long Pine Creek Rural Clean Water Program

MNNRD.................... Middle Niobrara Natural Resource District-Nebraska

NCC...................... National Coordinating Committee

NDEC..................... Nebraska Department of Environmental Control

NFS...................... National Forest Service

NGPC..................... Nebraska Game and Parks Commission

Noncost-share............ Practices employed that did not receive any reimbursement for installation.

NPS...................... Nonpoint Source

NRC...................... Natural Resource Commission

NRDs..................... Natural Resource Districts-Nebraska

NWQEP.................... National Water Quality Evaluation

Project

PL-566.................... Watershed Protection and Flood Prevention Act (PL83-566)

Pooling Agreement........ The pooling of resources, efforts, finances or other contributions by two or more eligible RCWP participants.

Practice Code............ Numerical identification given to individual practices (BMPs)

RC&D..................... Resource Conservation and Development-Nebraska

RCWP..................... Rural Clean Water Program

SCC...................... State Coordinating Committee

SD1, SD2................. Water Quality Monitoring Stations

Set-aside................ Cropland set-aside requirement for Feed Grain Program participation. Also known as ACR-Acreage Conservation Reserve.

STORET................... EPA Storage and Retrieval Data Base for Water Quality

Subbasin................. Hydrologic Unit designated by drainage

TAC...................... Technical Action Committee

Units Applied............ Units Reported by the SCS for each practice installed. Units Applied data is reported by individual practice code criteria.

USDA..................... United States Department of Agriculture

USGS..................... United States Geologic Survey

Demonstration Farm
Study Results

Liming Study 1985-1988: B-K-R CES

Objectives: (1) To evaluate the effect of various lime sources and rates on the soil and crop yields in a corn-soybean rotation on an acid sandy soil; (2) To demonstrate the economics of liming with various lime sources.

Procedure: The liming experiment was established in 1985 on a Valentne Boelus fine sand. Soil analysis in the spring of 1985 showed a pH of 5.6, 1% Organic Matter, 34 ppm Bray 1P, 138 ppm K, and 0.8 ppm sulfur. The liming recommendation was 1,000 pounds of ag lime/acre. Four treatments including a check, broadcast and incorporated ag lime, broadcast and incorporated pelleted lime, and row applied pelleted lime were used. The broadcast pelleted lime rate was selected by spending the same dollar amount as was spent for the ag lime. Ag lime was broadcast April 18 and incorporated by a sigle disking. Treatments were laid out in replicated strips which ranged in width from 20-50 feet wide the length of the pivot. Four replications were used.

No difference in soil pH for the various treatments was shown in 1986 and based on the soil tests from the limed plot an additional 3,000 pounds of ag lime was recommended (Table 1). In 1986 the ag lime plot from 1985 was split. Half received no additional lime while the other half received the 3,000 pounds of ag lime. The broadcast pelleted lime treatment was also split. Half did not receive any additional lime and the other half recieved a broadcast application of 1,250 pounds of pelleted lime per acre. The liming rates in both 1985 and 1986 for the pelleted lime were based on spending the same amount of money for ag lime. All broadcast lime treatments were incorporated by single disking. Soybeans were planted in 1986.

In 1987 no additional treatments were applied and corn was planted following the soybeans. The pH values of the various treatments over time show an interesting effect (Table 1). Following the year of corn in 1985 the soil pH levels in 1986 had declined by about half a pH unit. In 1987 following the year of soybeans, the pH had increased to its initial level at the start of the experiment. In 1988 pH levels had declined again following corn. The reason for this change in pH is the lime that is applied in the irrigation water during the growing season and the lack of nitrogen fertilizer. During years following corn production the pH is expected to drop because of the use of nitrogen fertilizer.

Table 1. pH values in the 0-8 inch depth before planting.

	1985 Corn	1986 Soybean	1987 Corn	1988 Soybean
Check	5.6 a*	5.1 a	5.5 b	4.8 ab
Ag Lime - 85	5.6 a	5.1 a	5.5 b	4.9 ab
Ag Lime - 85 & 86	5.6 a	5.1 a	5.7 a	5.0 a
Pelleted - 85	5.6 a	5.1 a	-	5.0 ab
Pelleted - 85 & 86	5.6 a	5.1 a	5.6 a	5.0 ab
Row-Applied	5.6 a	5.0 a	-	4.7 b

*Values followed by the same letter are not significantly different at the 10% level of probability.

There was a significant but inconsistent liming effect on soybean yield in 1986 and 1988 (Table 2). The highest rate of lime produced a significantly better soybean yield than the check. Other treatments were intermediate. During both 1985 and 1987 no significant lime effect was shown for corn. Yields were lower in 1985 due to a mid-season hail storm. In 1987 the poor performance of the row applied lime cannot be explained. Stand counts were not taken, however, the application of the pelleted lime with the seed for corn may have reduced the stand and the yield potential. This treatment did yield significantly less than the other treatments.

Table 2. Yields for the B-K-R corn-soybean rotation liming experiment.

	1985 Corn	1986 Soybeans	1987 Corn	1988 Soybeans
Check	115 a*	45.9 b	154 ab	50.2 ab
Ag Lime - 85	118 a	47.7 ab	158 a	54.8 a
Ag Lime - 85 & 86	-	51.4 a	154 ab	48.4 b
Pelleted - 85	114 a	46.1 b	151 ab	45.9 b
Pelleted - 85 & 86	-	45.4 b	152 ab	48.2 b
Row-Applied	117 a	47.6 ab	142 b	-
CV	4%	6%	7%	8%

*Values followed by the same letter are not significantly different at the 10% level of probability.

The 0-8" soil samples show only part of the picture. In 1987 and 1988 the plots were sampled at increments of 0-4, 4-8 and 8-16" (Table 3). The influence of lime is more evident in the 0-4" depth. Also note the lower pH in the

4-8" depth due to N application. The 1987 data showed the influence of liming even at the 8-16" depth.

Table 3. Soil pH for Ø-4, 4-8 and 8-16" samples.

	1987 Corn			1988 Soybeans		
	Ø-4	4-8	8-16	Ø-4	4-8	8-16
Check	5.7 c	5.3 a	5.6 c	5.Ø bc	4.6 a	5.Ø a
Ag Lime-85	6.Ø b	5.3 a	5.9 a	5.1 bc	4.7 a	5.1 a
Ag Lime- 85 & 8	6.5 a	5.5 a	5.9 a	5.6 a	4.8 a	5.Ø a
Pelleted- 85	-	-	-	5.2 a	4.8 a	5.1 a
Pelleted-85 & 86	6.1 b	5.4 a	5.7 b	5.3 b	4.8 a	5.1 a
Row 85-87	-	-	-	4.9 c	4.6 a	4.9 a

Based on previous work, liming on sandy soils may not be beneficial for corn until soil pH levels decline to less than pH 5.2. Liming did increase soybean yields in 1986. If the payback in a corn-soybean rotation is sufficient over a 5 to 8 year period, liming can be recommended.

Liming Study 1988-1989: Rick Runyan and Dennis Bauer

This study was conducted to see if applications of lime for continuous corn production would be cost effective by increasing corn yields. Soil samples were taken Ø-9" and 9-18" depth in the fall of 1987. The test results indicated that the Ø-9" depth had a pH of 4.9 and the 9-18" depth had a pH of 6.1. Ag lime was applied at the rate of 1,5ØØ pounds per acre on four of the plots. The other four plots received no lime. The corn yield in the fall of 1988 showed no significant difference in yield or moisture content at harvest (Table 1).

Table 1. Corn Yield and Moisture Content 1988

Check	Yield #2 Corn	Moisture Percent	1,5ØØ Ag Lime	Yield #2 Corn	Moisture Percent
Rep 1	176.94	27.5	Rep 1	169.24	26.4
2	-	-	2	166.28	25.8
3	179.47	26.Ø	3	178.16	27.Ø
4	168.94	27.5	4	172.66	26.Ø
Average	175.11	27.Ø	Average	171.58	26.3

Soil samples were taken in the fall of 1988 on each plot. The four plots where 1,500 pounds of Ag-lime had been applied ranged in pH from 4.8 to 5.0. The four check plots where no lime had been applied ranged in pH from 4.9 to 5.0. The 1,500 pounds of Ag-lime did not appear to raise soil pH. As a result, additional lime at the rate of 2,000 pounds of Pel-lime was applied to the plots that had received the intitial 1,500 pounds of Ag-lime in 1987. The Pel-lime was applied in the fall of 1988.

Corn yields and moisture content for the 1989 crop year are reorted in Table 2.

Table 2. Corn Yield and Moisture Content 1989

Check	Yield #2 Corn	Moisture Percent	1,500 lb. Ag-lime (87) 2,000 lb. Pel-lime (88)	Yield #2 Corn	Moisture Percent
Rep 1	163.7	17.6	Rep 1	140.4	19.5
2	153.2	18.0	2	156.4	17.8
3	139.6	18.3	3	150.4	18.1
4	154.5	18.4	4	160.3	18.0
Average	152.7	18.1	Average	151.9	18.4

There was no difference in yield or moisture content between the check and the liming treatment again in 1989. The two-year averages for yield show that the checked plots average was 163.9 bu/acre while the plots that were limed averaged 161.7 bu/acre. Soil test results taken after harvest in 1989 indicate that liming did raise the soil pH. The liming plots averaged 5.35 pH where as the check plots averaged 5.0 pH. Even though the soil pH was raised, a yield response was not achieved. The economics do not look real good as the liming cost for the 1,500 lbs. of Ag-lime/acre in 1987 plus 2,000 lbs. of Pel-lime/acre in 1988 was approximately $85/acre.

This study confirms what other studies have shown (B-K-R Demo Farm Liming Study 1985-1988) that liming on continuous corn does not increase corn yields even though soil pH can be raised by application of lime.

Demonstration Farm
Study Results
Phosphorus Rate and Method Experiment - 1987-1988

What is the best method to apply phosphorus for corn grown on sandy soils? Does the initial soil test level influence the method and rate that are required for maximum production? These two questions were the primary guides in designing a phosphorus experiment at the Demo Farm.

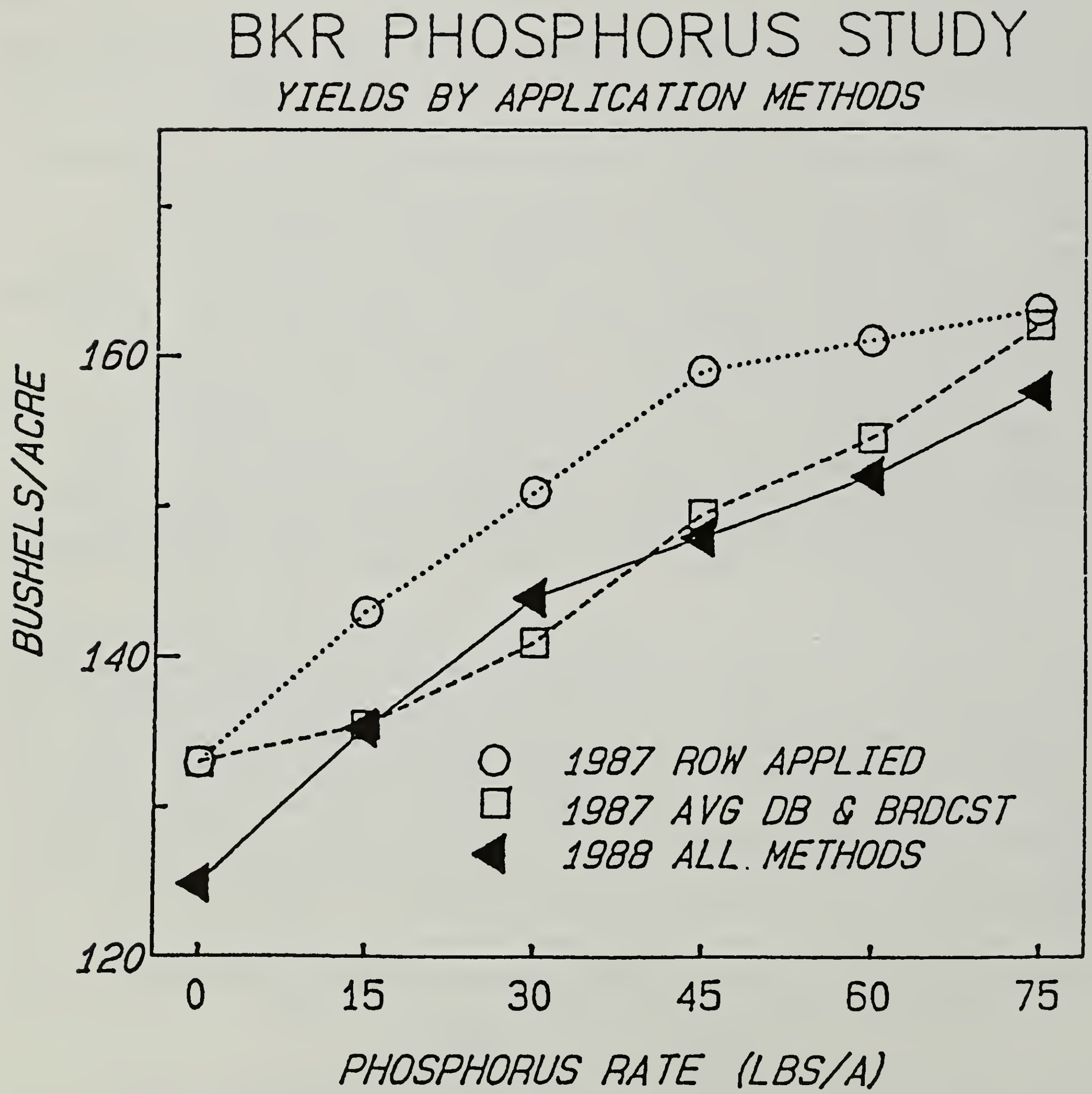
Phosphorus was applied to 80' by 80' blocks in the spring of 1986. The phosphate rate applied was 0, 40, or 80 lbs/P205/A. A corn crop was grown on this area in 1986. In the spring of 1987, soil samples were taken from this area and showed that the check area had a soil test level of about 5 ppm P, the area fertilized with 40 pounds of phosphate had a soil test level of about 9 ppm and the area receiving 80 had a soil test level of 13 ppm P. A phosphorus rate by method experiment was designed for this area and fertilizer was applied in the spring of 1987 and 1988. The phosphorus application methods used included broadcast, deep banded or knifed in and row application at planting time. 10-34-0 was the phosphorus fertilizer used for each method. Nitrogen rates were balanced by inclusion of nitrogen solution so nitrogen was balanced between all treatments. Phosphorus rates were 0, 15, 30, 45, 60 and 75 pounds of phosphate/A.

The results (Table 1) showed no difference in response based on itital soil test P level. Consequently data have been averaged to show the effects of application method and P rate. In 1987 row-applied P was significantly better than broadcast or deep banded P. In 1988 there was no difference among methods. Due to lack of consistent method differences, more sites will need to be run to recommend one method over another.

Table 1 Grain yield for the rate x method Experiment
Initial Soil P Application in 1986

METHOD	1987	1988
Broadcast	149 bu/A	147
Deep Band	148	148
Row	155	147

RATE-lbs/A	1987 Bcst	1987 DP Band	1987 Row	1988 Bcst	1988 DP Band	1988 Row
0	133	133	133	125	125	125
15	135	136	143	136	134	136
30	140	142	151	144	147	141
45	153	146	159	147	150	147
60	157	152	161	150	152	154
75	160	164	163	157	158	158


BKR PHOSPHORUS STUDY
YIELDS BY APPLICATION METHODS
BUSHELS/ACRE
160
140
120
0
15
30
45
60
75
PHOSPHORUS RATE (LBS/A)
1987 ROW APPLIED
1987 AVG DB & BRDCST
1988 ALL. METHODS

Soil Test Lab Comparison Experiment on the B-K-R Demonstration Farm - 1987-1990 -Gary W. Hergert, Dennis Bauer and Bud Stolzenburg

Objectives: (1) Determine if soil lab recommendations from commerical labs and UNL varied widely on a low fertility sandy soil; (2) Determine if UNL recommendations are adequate to produce economic yields on sandy soils.

A soil test lab comparison study conducted by the University of Nebraska showed a wide range in fertilizer recommendations between a number of laboratories (Dept. of Agron.1985). These experiments confirmed the accuracy of the laboratories' analytical techniques but these experiments were conducted on silt loam soils that were high to medium fertility. The University has a major responsibility to provide research information upon which fertilizer recommendations are made to farmers and commercial soil testing labs. These experiments provide a check on the University recommendations.

Procedure: A composite soil sample from a Boelus-Valentine sand association near Bassett, NE was taken out of the four replications for a given laboratory and sent to the laboratory under a farmer's name. The experiment has been run for four years (1987-1990). The four laboratories selected were A&L Laboratories, Harris, Servi-Tech and UNL. The actual soil test results are shown in Table 1. There was fairly good agreement between the different soil test levels before fertilizer was applied in 1987. The analysis showed that the site was low in most nutrient levels. The biggest variation in analytical values was for sulfur and zinc because of lab methods used. Soil test levels showed increases over time, but it took 2-3 years for soil P to increase (Table 1). Zinc showed an increase after the first year.

Laboratories were provided with information on soil type suggesting a yield goal of 165 bu/A of corn. The actual fertilizer recommended by the different laboratories is shown in Table 2. To provide for the best nitrogen management between laboratories all of the nutrients plus 40 pounds of nitrogen was applied preplant in 1987 and 1988 to each of the plots. During 1989-1990 only 30 lbs N/A was applied preplant with all other nutrients. The remaining nitrogen was applied as a sidedress application of ammonium nitrate when the corn was approximately 2 feet tall. This method of fertilizer application showed incorporation of broadcast phosphorus, sulfur, zinc, and other micronutrients or secondary nutrients. It also provided a split

application for the nitrogen to best utilize the itrogen that was recommended by the laboratories. Plots were double disked after preplant fertilizer application.

Nitrogen recommendations for two of the labs have decreased significantly during the last 2 years. The factor (F) for yield goal XF=N recommendation appears to have come down from 1.33 to about 1.06. This may reflect national and regional concern about N and ground water quality. Other nutrients (P,K and micronutrients) still appear to be recommended on a soil test plus crop removal basis for A&L and Harris.

Yield data are shown in Table 3. No differences were shown in 1987. In 1988 there was a significant yield difference between labs. The 40# preplant N was applied but 40# of N was also applied with the herbicide. Because of heavy early spring rains, leaching occurred. The 90# of N left for sidedressing University plots was not sufficient to meet yield demands. The data emphasizes the importance of proper N management and that soluble forms of N can be lost. No more than 40# of N/A as a preplant is recommended for sandy soils when dry or liquid N is used.

There is year to year variation and in 1989 there was a significant yield difference showing Harris Lab recommendations producing the highest yields (Table 3). The 4 year yield average, however, shows no significant grain yield differences among labs. The yield average is very close to the yield goal of 165 bu/A. In 1990 there was a significant difference in yields between the labs. UNL was highest while A&L was significantly different than Harris.

The fertilizer recommendations on the four year average shows a $46 difference between the highest recommended fertilizer program and the lowest recommended fertilizer program (Table 4).

The results from this four year study are not different than those attained over the 15 year history of soil test lab comparison experiments previously conducted by UNL. The information shows that the laboratories are doing a good job of providing analytical results although differences in recommendations remain. Two laboratories (UNL and Servi-Tech) are recommending on a deficiency correction basis and both produced very good yields. The results confirm that the deficiency correction approach does not limit yields or benefits if the yield attained is above the specified yield goal (1987 data). If this were not true, the higher N, P, K, and S rates would or should have produced a higher yield, especialy after four years. The Servi-Tech Laboratory produced the yield at a similar cost to UNL's. The other two laboratories' costs were increased by larger additions of phosphorus, potassium, sulfur, micronutrients and

secondary nutrients. Past research on Nebraska soils shows that many of these nutrients often do not provide economic yield increases.

Table 1. Soil Test Results for the B-K-R soil test lab comparison, 1990.

Lab.	Year	pH	%OM	P	K	Zn*	S	Mg	Mn	Cu	B
				ppm							
A & L	1987	5.9	1.8	7	98	0.8	9	-	-	-	-
A & L	1988	5.8	1.3	4	103	1.6	11	76	5	0.4	0.7
A & L	1989	5.3	2.2	21	171	4.3	14	97	17	1.1	1.1
A & L	1990	5.8	2.2	21	192	2.9	20	124	21	1.0	0.9
Harris	1987	6.0	1.4	4	107	0.8	9	-	-	-	-
Harris	1988	6.1	1.4	11	118	2.1	3	81	4.4	0.4	0.5
Harris	1989	5.4	1.5	14	151	2.2	2	67	7.2	0.7	0.2
Harris	1990	5.5	1.5	16	131	1.5	3	81	5.3	0.4	0.5
Servi-Tech	1987	6.2	1.7	5	146	0.8	6	-	-	-	-
Servi-Tech	1988	5.7	1.5	13	138	1.4	10	79	5.6	-	-
Servi-Tech	1989	5.5	2.4	10	128	1.3	5	71	8.4	0.3	-
Servi-Tech	1990	5.5	2.3	14	140	1.2	6	73	6.0	0.3	-
UNL	1987	6.0	1.5	5	125	2.7	1	-	-	-	-
UNL	1988	6.6	1.5	8	123	5.4	3	-	-	-	-
UNL	1989	5.4	2.0	11	187	6.7	-	-	-	-	-
UNL	1990	5.7	1.8	8	125	5.5	2	-	-	-	-

*UNL runs 0.1 N HCl Zn. Other use DTPA

Table 2. Fertilizer Recommended for 165 bu/A Corn

Lab.	Year	N	P2O5	K2O	S	B	Cu	Mg	Mn	Zn
A & L	1987	220	110	140	25	1.0	1.5	22	3.5	5.0
A & L	1988	210	115	140	14	1.0	1.0	30	3.0	3.0
A & L	1989	190	70	90	11	0.0	0.0	22	0.0	0.0
A & L	1990	175	60	75	0	0.0	0.0	0	0.0	0.0
Harris	1987	195	135	125	35	1.5	2.3	20	5.5	10.0
Harris	1988	195	95	110	35	1.3	0.5	20	2.0	0.0
Harris	1989	180	90	70	35	1.5	0.0	25	0.0	0.0
Harris	1990	175	85	95	30	1.3	0.5	20	0.0	0.0
Servi-Tech	1987	165	95	25	15	0.5	0.0	0	0.0	3.0
Servi-Tech	1988	210	65	30	0	0.0	0.0	0	0.0	0.0
Servi-Tech	1989	185	75	35	0	0.0	0.0	0	0.0	0.0

Servi-Tech	1990	190	60	30	0	0.0	0.0	0	0.0	0.0
UNL	1987	170	100	40	20	0.0	0.0	0	0.0	3.0
UNL	1988	170	40	40	20	0.0	0.0	0	0.0	0.0
UNL	1989	170	40	0	20	0.0	0.0	0	0.0	0.0
UNL	1990	170	40	0	20	0.0	0.0	0	0.0	0.0

Table 3. Grain Yields from the B-K-R Soil Lab Comparison Experiment

Laboratory	1987	1988	1989	1990	4 Year Average
A & L	182 a*	144 a	163 b	154 ab	161 a
Harris	180 a	137 bc	178 a	143 c	159 a
Servi-Tech	184 a	139 b	169 b	150 bc	159 a
UNL	186 a	133 c	168 b	159 a	162 a

*Values followed by a different letter are significantly different at the 5% level using Duncan's new multiple range test.

Table 4. Fertilizer Costs for the Different Lab Recommendations

Laboratory	1987	1988	1989	1990	4 Year Average
A & L	$109	$106	$70	$53	$85
Harris	$121	$ 91	$82	$81	$94
Servi-Tech	$ 62	$ 54	$53	$49	$54
UNL	$ 65	$ 46	$41	$41	$48

Fertilizer cost per pound used were N- $0.15, P-$0.28; K-$0.13; Mg- $0.38, S-$0.20, Zn-$0.90, Mn-$0.80, Cu-$2,50, and B-$2.70.

Demonstration Farm
Study Results

Residual Nitrate Demonstration Project - 1991

Bud Stolzenburg, Dennis Bauer, Steve Pritchard, Jack Robinson

This report covers the work done in the B-K-R area only.

Purpose: To demonstrate the effectiveness of deep soil sampling for residual nitrate and to use these findings to fine tune nitrogen fertilizer use on irrigated corn.

Results: In 1991, 21 producers participated in this project. The B-K-R Extension staff took samples on over 60 fields representing over 2,000 acres of farm land. Farmers were encouraged to ride along as the sampling was being done to see how the procedure worked. Many of the producers spent some time in the probe truck as samples were being taken. The results of the sampling are shown on Table 1.

Table 1.

	Pounds of Residual Nitrate Nitrogen			
	Under 50#	50-99#	100-199#	over 200#
% of the Fields	7.8%	56.8%	31.4%	4%
Avg. # of lbs.	40#	70.3#	126.4#	266.5#

When all of the fields are averaged together, there are 93.2 lbs. carry over. The average nitrogen recommendation for 150 bu. corn was 90 lbs. based on the deep sampling results. A comparison of fertilizer recommendations can be found in Table2.

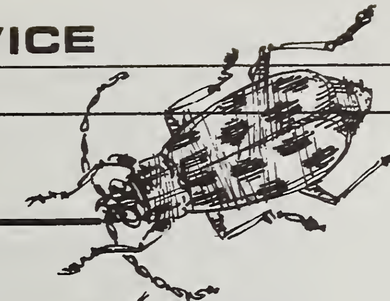
Table 2. Comparisons of Fertilizer Recommendations for 150 bu. corn

# of N without deep sampling	# of N based on deep sampling	# of N reduced
165/acre	90/acre	75/acre

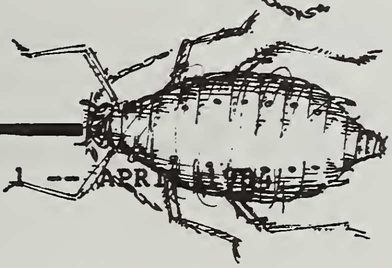
This represents a 45% reduction in the amount of nitrogen that is needed to produce 150 bu. corn. This amounts to a reduction of over 150,000 lbs. or 75 tons of nitrogen on these 2,000 acres. Many producers are testing the results by using check strips. Other producers are using the results on a whole farm basis. Results will be presented at area producer meetings, news releases and through an insert in the ASCS newsletter. This program will continue again in 1992 in the Sandhills EPU.

COOPERATIVE EXTENSION SERVICE

INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES



Long Pine Area INTEGRATED PEST MANAGEMENT Newsletter



VOLUME II, NUMBER 1 -- APRIL 1984

GREETINGS

GREETINGS from the BKR COOPERATIVE EXTENSION SERVICE. This issue of the LONG PINE AREA IPM NEWSLETTER is the first issue of its second year. The newsletter is aimed at growers from the BKR area engaged in crop production.

The newsletter tries to bring together information from many sources about different areas of crop production. The information is presented on a timely basis to offer the most benefit to growers.

INTEGRATED PEST MANAGEMENT, as the title suggests, is the main concern of the newsletter. Insect, disease, and weed problems and solutions are especially emphasized. Articles related to other plants of concern are also included at times.

This issue of the newsletter is being sent to everyone that was on the mailing list last year. Anyone else wanting to be included on the mailing list free of charge can get on by just contacting the BKR Cooperative Extension Office, phone 387-2213.

Paul

Paul Koerner, Extension Agent-Agriculture

1984 BUG FORECAST

Really, it's anybody's guess. EXCEPT that we are almost certain to have quite a few troubles with alfalfa weevil and with corn flea beetles. Overwintering conditions were good. Most hibernating insects covered with snow prior to the December cold snap probably survived in pretty good shape.

For some crop pests, such as European corn borer (ECB), overwintering levels may not make much difference. The ECB has a very high reproductive capacity and can bounce back to become a problem even though overwintering numbers were low. Weather in June and early July is probably the most important factor in determining ECB first generation levels. Cutworm and armyworm infestations will depend on weather, generally being favored by a cool, moist spring that generates a lot of weed growth. Spider mites, however, are favored by dry conditions, especially when these occur in early to midsummer, as they did in 1983. As a general rule, insects are available to take advantage of just about every set of conditions.

FIRST

YEAR

CORN &

SOIL

INSECTICIDES

Recent TV, radio and magazine advertising is directing farmers to apply soil insecticides at planting on first year corn, "just in case" soil insects such as rootworms, cutworms, wireworms, etc. are present. Historically, University of Nebraska Extension Entomologists have recommended against the use of "insurance-type" applications of insecticides, unless the odds of having a problem are significant. When reading this advertising, remember that our BEST recommendations for corn rootworm control is to practice crop rotation. In the case of PIK acres, the odds of significant infestation by rootworms and most other soil insect pests are low and in most cases will not justify the use of a soil insecticide. We do not support the routine use of soil insecticides in these and other situations, on first year corn, as outlined in "yield challenges" and other forms of promotional advertising. Unnecessary usage of chemicals adds needless expense to already high production costs, can result in environmental side effects, and can hasten the development of resistance to insecticides. Furthermore, no soil insecticide manufacturer has enough data to prove that use of their product consistently gives a yield advantage. We see no reason to go to the trouble and expense of using these products unless the threat is a real one.

Where insects are likely to be a problem, we do not hesitate to recommend appropriate control measures, including soil insecticides. When are insecticides necessary on first year corn?

1. FOLLOWING SOYBEANS INFESTED WITH WEEDS OR VOLUNTEER CORN. Heavy infestations of flowering weeds or volunteer corn in excess of 5000 plants per acre can attract corn rootworm beetles, which may then deposit eggs. First year corn can be damaged in these cases, and may benefit from soil insecticide treatment. In about 15 drought affected counties in southeast Nebraska, the odds of having some damage from rootworms following soybeans is probably increased somewhat, since many corn fields were unattractive in midsummer 1983. But - the odds of having a problem are not as high as having rootworms in a normal continuous corn situation.

2. FOLLOWING WEEDY OATS STUBBLE, ESPECIALLY IN NORTHEAST NEBRASKA. The northern corn rootworm, most common in northeast Nebraska counties, can infest corn following oats, if flowering weeds were attractive to moving beetles in July and August of 1983. Such fields should be treated with soil insecticides.

3. FOLLOWING PIK ACRES THAT WERE ALLOWED TO BECOME VERY WEEDY IN 1983. A few fields which fall into this category will benefit from treatment with soil insecticide - again, if weeds attracted significant numbers of beetles last summer.

What about the possibilities for other insects on first year corn - cutworms, wireworms and other seed-attacking pests? In the case of cutworms, the weather and weed infestations this spring are probably the most important determining factors, not

PIK. In any case, soil insecticides applied at planting do not give consistently good control of cutworms, especially if populations are heavy. Best control is obtained by spraying after cutworm damage first appears, usually in late May or early June.

INSECTICIDES CONT'D

Seed attacking insects such as wireworms, seed corn beetles and seed corn maggots can be prevented cheaply with a planter box seed treatment, which should provide effective protection in all but instances of extremely heavy infestation. The chances are very slim indeed of such an occurrence. If wireworms were present in a field in 1983 or the field is coming out of pasture sod and being planted to corn, a seed treatment plus an infurrow or banded treatment with one of the approved soil insecticides is recommended.

FIELD SCOUT TRAINING SESSIONS

These sessions emphasize training in the fundamentals of insect, weed and plant disease scouting. These fundamentals include pest identification, life cycles, damage recognition and methods of scouting fields. This year, there are three scouting schools in Nebraska under the direction of L. W. Andersen, K. Jarvi, and G. Johnson. Dates, times and locations are as follows: May 16, 8:30 a.m., Lincoln East Campus Union; May 18, 9:00 a.m., North Platte Station Auditorium; May 21 - 9:00 a.m., Northeast Station at Concord.

IPM ASSN. AVAILABLE TO ALL

The 1984 growing season marks the second year for the Long Pine Area IPM Association. The Association was formed to allow local growers to have their fields scouted for insect problems at a very reasonable cost ($1.00/acre). If you have an interest in the association, contact association president, Chuck Haase, at 722-4246.

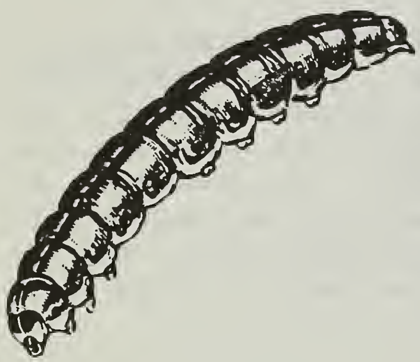
INFURROW VS. BAND FOR CRW CONTROL

Where heavy infestations of wireworms, other seed-attacking insects or white grubs are anticipated, or where heavy surface residues (such as in no-till) may prevent proper incorporation of a 7-inch band, the infurrow treatment may be advantageous. However, where corn rootworms are the primary target pest, the banded treatment of soil insecticide is probably preferred over the infurrow or "T-banded" treatment. Dr. Z. B. Mayo's research indicates that the banded treatment usually results in a lower (improved) root damage rating than infurrow treatment of the same soil insecticide. Also be aware that only a few compounds are approved for direct application into the seed furrow - carbofuran (Furadan 15G)m terbufos (Counter 15G) and chlorpyrifos (Lorsban 15G). Accidental or purposeful application of other compounds in the seed furrow may interfere with seed germination. However, proper application of ethoprop (Mocap 15G), fonophos (Dyfonate 20G), phorate (Thimet 20G) or trimethacarb (Broot 15G) as banded treatments at planting should not result in stand losses, and should provide effective control of corn rootworms.

CUTWORMS

Corn planted into stubble (small grain), pasture, sod, or alfalfa is more likely to develop cutworm problems in late May or early June. Cutworm populations are also more common in fields that are infested with winter annual weeds (mustards) and on river bottom lands. Prediction of cutworm populations is very difficult, but the above conditions appear more conducive to problems.

Dingy cutworms overwinter as larvae and are the first destructive spring species. They are more often found in fields following legumes, or in fields with heavy crop residues. There is only one generation each year.



Black cutworms, one of our more damaging species, appear slightly later than the Dingy. Black cutworms arrive in Nebraska early in the spring, before corn is planted and eggs are deposited on grasses and weeds. When corn plants emerge and weeds are destroyed by herbicides or cultivation, the cutworms attack the corn. There is more than one annual generation per year, but only the first is important on corn.

Cutworm control: Pre-plant incorporated or planting time applications are preventive treatments and would be feasible only on fields with a cutworm "history". Diazinon 4 lb AI/acre, Lorsban 2 lbs AI/acre, Dyfonate 4 lbs AI/acre are materials that could be used pre-plant but probably are not feasible in most situations. Planting Time applications of Lorsban, Mocap, Dyfonate or Counter may reduce some of the early cutworm infestations, but are not likely to provide good control if infestations are high.

Mocap and Dyfonate can reduce stands if allowed to fall into the seed furrow. Lorsban and Counter are safe to germinating seeds. If any products are used at planting time, continue to scout fields for cutworm activity and use a rescue treatment if necessary.

Rescue treatments: Broadcast applications (aerial or ground) of Lorsban 4E at 2-3 pints per acre or Pydrin 2.4EC at 5 1/3 - 10 2/3 fl. oz. per acre are two of the more effective cutworm controls. Sevin, diazinon or Dylox can also be used.

If fields are dry or cloddy, rotary hoeing after application should increase cutworm control. Scout fields regularly after plants emerge. The best guide for rescue treatments is to apply a chemical treatment when 5 percent (1 of 20) of the plants are cut or chewed (look for ragged leaf margins).

Lorsban 4E may also be applied through center pivot irrigation systems as a post-emergence broadcast application for cutworm control. While Pydrin is not specifically labeled for pivot application it could legally be used.

FIRE BLIGHT OF ORNAMENTALS AND TREE FRUITS

The disease called fire blight is caused by a plant pathogenic bacterium that can infect over 75 different host plants. Some of the more common hosts are apples, pears, pyracantha, cotoneaster, quince, mountain ash and strawberry. The disease is difficult to control with chemical sprays alone. Hence, a coordinated control program is needed. Proper pruning of diseased branches is one of the important steps. Diseased branches should be pruned during the dormant season at least 12 inches below the blackened, diseased area. Cutting tools should be sanitized in a 5% dilution of a liquid chlorine bleach or 70% rubbing alcohol after every cut to prevent spread of the bacteria. Destroy all pruned material. Applications of an antibiotic such as streptomycin (Agrimycin) should be initiated at the pink bud stage (3 to 4 days before blossoms open), and repeated every 5 to 7 days for about 3 weeks. Spraying in the cooler hours of the day gives better absorption due to slower drying, but do not spray when daytime temperatures are below about 65 degrees F.

HOW THE NEW GRASS KILLERS WORK

Research report on postemergence herbicides...The recently introduced grass killers Poast and Fusilade, and their yet-to-be-released cousins, represent a new era in over-the-top weed control for soybeans, cotton and other broadleaf crops. Their low application rates and high effectiveness gives a new weapon of a caliber seldom seen before.

Although these two new herbicides are different chemically, they do have a lot in common. Both are systemic. Sprayed over the tops of actively growing grass plants, they are absorbed through the leaves. From there they are transferred throughout the plant and accumulated at plant growing points like roots, stolons and rhizomes where they start killing the plant. You generally won't see any visual effects immediately but the weeds quit growing and competing with the crop for moisture and nutrients. Visual symptoms start developing gradually.

The first signs of herbicide activity start appearing in about seven days. Decay begins to show at the growing points and nodes. The plant leaves start losing green color and vigor. Foliage slowly turns a light brown or reddish, purple color much like some maple leaves in autumn. The plant tissue gradually darkens as the decay spreads over entire plant.

Both chemicals are applied over the top of growing crop and weeds. BASF recommends a nonphytotoxic oil concentrate be added to the spray.

For Fusilade, ICI Americas recommends adding either a nonphytotoxic oil concentrate or a nonionic surfactant to the spray mixture.

Both herbicides are concentrated so you actually use very low rates compared to most herbicides. Poast's lowest recommmended

GRASS KILLERS CONT'D

rate is 1/2 pint per acre; Fusilade's lowest is 1/4 pint per acre. Both manufacturers suggest applying a minimum of 10 gallons of spray per acre and minimum of 30 psi sprayer pressure for good coverage.

Growers concerned about effects of rain after making postemergence applications need not worry. Both products are considered rainfast within an hour of application.

Neither product should be tank mixed with other herbicides. Exception: Poast may be applied with Basagran, but Poast's rate must be increased 50%. Tank mixed, an antagonism may develop which can reduce grass kill. You can get around this by applying them separately.

--Successful Farming, February, 1984

LONG PINE AREA IPM ASSN
BROWN COUNTY COURTHOUSE
AINSWORTH NE 69210

WINTER 1982

Long Pine Rural Clean Water Program

VOLUME 1 NO. 2

NEWS LETTER

Weigh Wagon Test Results Show Good Yields

Dennis Bauer, B-K-R Extension Agent, weighs a yield sample using weigh wagon available for use by Long Pine watershed landowners.

Listed below are the results of seven weigh wagon checks taken this fall:

Name of Producer	Number of Tests	High Yield bu/A. 15.5%	Low Yield bu/A. 15.5%	Avg. Yield bu/A. 15.5%
Preston Brothers	33	149	115	135
Paul Plate	11	138	110	124
Steve Bejot	13	157	125	140
John Hladky	15	165	138	150
Henry Rudnick	9	150	122	140
Charles Haase	14	147	107	121
Blaine Johnson	12	149	123	138

The B-K-R Extension Service conducted several weigh wagon checks this fall to determine yields on as many farms as possible.

The importance of these weigh wagon tests is to enable farmers to set more realistic yield goals in the future. Setting a realistic yield goal is important especially since most recommendations for nitrogen fertilizer are based on one's yield goal.

According to University of Nebraska research, it takes 1.1 to 1.2 pounds of nitrogen per bushel of corn produced. Example: For 150 bushel corn yield, the nitrogen needed would be between 165 and 180 pounds of nitrogen.

These tests included many different varities from several seed corn companies. An in-depth report will be available from the B-K-R Extension Office after January 19, 1983, which will list all varieties tested by individual farms along with the producer's fertilizer program and soil test results for the 1982 crop.

Agencies Cooperate in Long Pine RCWP

The Long Pine RCWP is a joint effort of local, state, and federal agencies. These agencies all have one common objective where the Long Pine RCWP is concerned — that being to improve the overall water

(Continued on page 4)

For more information, contact:
Agricultural Stabilization & Conservation Service, Route 2, Ainsworth, Nebraska 69210; Phone 387-2242
Cooperative Extension Service (Brown-Keya Paha-Rock), 148 West Fourth St., Ainsworth, Nebraska 69210; Phone 387-2213
Soil Conservation Service, Route 2, Ainsworth, Nebraska 69210; Phone 387-2242

Soil Nitrate

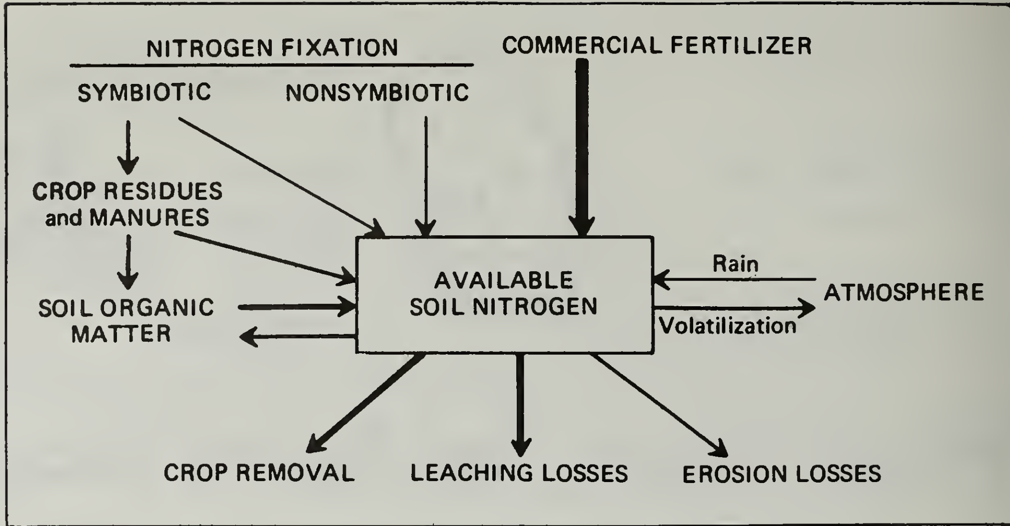


Figure 1[a]: Major gains and losses of available soil nitrogen. Arrow widths indicate approximate magnitude of gains and losses. ([a]*From Brady N.C., The Nature and Properties of Soils, Macmillan Publishing Co., Inc., New York.)*

Nitrate is an essential component of the soil ecosystem. When lost in excessive amounts, mainly by leaching, health and economic concerns can be created. The increased acreage of irrigated cropland in the Long Pine watershed during the past few decades has made groundwater contamination by nitrate a concern. Nitrate has been known for many years to be a health concern when ingested in excessive amounts. Nitrate is also one of the main forms of nitrogren that plants utilize. Because of this, nitrate lost to groundwater is an economic loss since a majority of nitrate in cropland originates from fertilizer applications. These concerns make it important to understand some of the basic properties that affect nitrate accumulation and movement in the soil.

Nitrogren is essential to plant growth. Soil nitrogen exists in four main forms. These forms include: organic, ammonium fixed by clay minerals, soluble inorganic ammonium (NH_4+) and soluable inorganic nitrate ($N0_3$-). Nitrogen is just one of the many nutrients required for the growth of plants. However, it is the nutrient most limiting to food production by plants.

All forms of nitrogen found in the soil ecosystem are not readily available to plants. The organic forms such as humus and organic matter contain nitrogen that is tightly bound and temporarily unavailable to plants. It is the inorganic forms such as nitrate and ammonium that are taken up by plants. The organic forms of nitrogen are not unavailable to plants forever. The tremendous numbers and types of microorganisms found in the soil are constantly feeding on organic compounds and releasing small amounts of inorganic nitrogen, available to plants.

Plants see no difference in nitrate or ammonium whether it comes from a commercial fertilizer, manure, or from mineralized organic matter in the soil. Research is being conducted at the University of Nebraska as well as other universities to help determine the amount of plant available nitrogen that can be expected to mineralize from organic sources during a specific growing season.

Nitrogen enters the soil ecosystem by many different means. A general balance sheet for plant available soil nitrogen is shown in Figure 1. Most soil nitrogen is originally derived from the atmosphere around us which contains about 70% nitrogen in a very unreactive gaseous form. This is equal to approximately 34,000 tons of nitrogen over every acre.

Atmospheric nitrogen enters the soil by the work of certain soil microorganisms fixing gaseous nitrogen in a close association with legumes. Also, an average of about 5 pounds of nitrogen per acre is deposited by rain bringing nitrogen containing pollutants down from the atmosphere. Small amounts of gaseous nitrogen are also fixed by lightning. When crop residues are returned to the soil, the nitrogen they absorbed during growth is also returned. Fertilizers are by far the biggest input of nitrogen for cropland.

The most important factor effecting nitrate-N loss is its high solubility in water. Water percolating down through the soil or across the surface as run-off can carry nitrate away from the crop. When water percolates down through the soil carrying nutrients it is called leaching. In sandy soils, which have a very limited water holding capacity, this can be a problem. Since nitrate is so water soluble, the nitrate present in the crop's rooting zone can be moved down into the groundwater by excess water leached through the soil. The excess water can be from natural precipitation or irrigation.

The keys to limiting the amount of nitrate leached into the groundwater are: 1) proper fertilization based on a realistic yield goal, 2) nitrate testing from soil samples to at least three feet, and 3) irrigation scheduling.

Denitrification can also result in the loss of nitrate-N from the soil. Denitrification often occurs when a soil becomes saturated with water. The amount of oxygen then becomes limiting and anerobic conditions result. Under anerobic conditions certain types of micro-organisms proliferate. These micro-organisms utilize nitrate in place of oxygen and give off gaseous forms of nitrogen which are lost to the atmosphere. In sandy soils this normally isn't a problem except where a high water table is encountered.

Nitrate-N is an essential part of the soil ecosystem. It is essential for plant growth but must be managed correctly. Proper nitrogen management will be economically beneficial as well as help prevent future contamination of our surface and groundwaters by nitrate.

Water Quality Planning Process

Some landowners may be hesitant to sign up for the Rural Clean Water Program because of the unfamiliarity of such a new program. Long Pine Creek RCWP is one of 23 such experimental projects in the nation.

Long Pine Creek RCWP is a ***strictly voluntary*** program for landowners and operators in the designated critical area. The primary purpose of the RCWP is to improve the water quality of both surface and groundwater while maintaining agricultural productivity.

The first step is to sign an application at the ASCS office, this simply means the cooperator would like a representative to discuss the program and how it would pertain to their operation. There is absolutely no obligation at this time. This application is then reviewed by the local Natural Resources District Board and ASCS County Committee. They determine its priority, either high or low. The high priority applications are then sent to the SCS. Low priorities are kept until all high priority applications have been serviced.

A representative of the SCS will then meet with the landowner and/or operator for an on-site investigation of the operation. Together a water quality plan is developed that addresses any present or potential problems, without sacrificing productivity. In many cases productivity is increased or at least made more cost effective.

At this point there must be total agreement from both parties. If the cooperator doesn't agree with the plan and no acceptable alternatives can be found, then this is all the farther it goes. If the landowner is agreeable, a complete water quality plan is prepared. This contains photos, soil information, job sheets and other information. Also included is the plan of operations which is a schedule of the work if needed, and a guide for the yearly management practices recommended. Any work needed is cost shared at 75% of the actual cost.

The water quality plan of work can run from 3 to 10 years, depending on the extent of the problems. Allowing this much time gives the cooperator a high degree of flexibility to complete any work in a manner that best fits his operating or economic abilities. Contracts may be modified where there is a change in status of the participant, the land under agreement, or farming operations.

Some cooperators may think the only cost share available is for the construction of conservation practices and structures. This is a common misconception. The RCWP has cost share for many management practices such as grazing systems, conservation tillage, irrigation water management, fertilizer and pesticide management along with grass seedings and tree plantings.

If water quality problems are not evident or the cooperator is unsure, it is also very important they sign up. Minor problems can be corrected before they become major problems. Even if no problems exist, each landowner is eligible for up to $50,000 cost share. Their share could then be used to assist on larger structures within the critical area where others have reached their cost share limit. In any case, a water quality plan is written and can be used as a management tool by the cooperator. In the Long Pine Creek RCWP, landowners can help the solution without being part of the problem.

Upcoming Meetings

Fertilizer Management Workshops

Jan. 19, 7 p.m., Springview Courthouse

Jan. 20, 10 a.m., Ainsworth Methodist Church

Jan. 20, 2 p.m., Bassett Holy Cross Catholic Church

Crop Protection Clinic

Jan. 27, 8:50 a.m., O'Neill Legion Club

Commercial Pesticide Applicator Training

Recertification

Feb. 15, 9 a.m., Ainsworth Methodist Church

Initial Certification

Mar. 3, 8:30 a.m., Ainsworth Methodist Church

Water Management & Tillage Workshop

Mar. 2, TBA, Ainsworth

Training Sessions

Irrigation Shortcourse

An irrigation shortcourse will be given January 24 and 25 in Lincoln. The course is sponsored by the Agricultural Engineering Dept., Cooperative Extension Service, and IANR in cooperation with the Division of Continuing Studies. It will be held at the Nebraska Center for Continuing Education, 33rd and Holdrege Streets.

The course includes 25 different presentations. Many different aspects of irrigation will be discussed. The cost of the short course is $43, which includes lunches, coffees, and a copy of the proceedings. Accommodations are also available at the center. For further information, contact the extension office 387-2213.

Conservation Tillage Meeting

An estimated $260 million worth of losses due to the unusually heavy rainfall of the past spring should increase interest in a series of area conservation tillage meetings to be held in February and March across the state. The six area meetings will give farmers the opportunity to learn about current technology and to discuss problems that can occur with conservation tillage methods. Program highlights will include tillage system evaluations, and weed and insect control as well as economic, disease and fertility considerations.

Meetings will be conducted by staff from the NU Institute of Agriculture and Natural Resources, Soil Conservation Service, and Natural Resources Districts. Registration fees are $8 per person if paid prior to the meeting and $10 at the door. Meeting locations and dates are: Febr. 11—Fremont; 15—Deshler; 17—Aurora; 24—Beatrice; 28—Humbolt; March 9—Columbus.

For further information contact the B-K-R Extension Office, 387-2213.

Agencies Cooperate . . .

(Continued from page 1)

quality of Long Pine Creek and maintain it for future use. The program efforts of two of these organizations are outlined here.

NRD

Staff personnel from the Middle Niobrara NRD assisted in the formulation of the original request for a Rural Clean Water Program (RCWP) in the Long Pine Creek drainage area in 1979. Through the efforts of many agencies, the request was updated, resubmitted and approved for funding in 1980. When the approved Rural Clean Water Program was received, committees were organized for administration of the program. Middle Niobrara NRD personnel were assigned membership on the Local Coordinating Committee, the Information and Education Committee, the Technical Coordinating Committee, and the Executive Committee. The Middle Niobrara NRD Board of Directors reviews each application for RCWP funding and together with the county committee, determines the priority for each application, based on established criteria developed by the Local Coordinating Committee. No water quality plan can be implemented without NRD approval thereby insuring local control by elected representatives. Several Middle Niobrara NRD Directors have attended various committee meetings relative to the Long Pine RCWP thus keeping current on program progress and problem areas. The Board of Directors of the Middle Niobrara NRD also discussed the status of the RCWP at the monthly board meetings and make applicable decisions relating to the program.

NRD contracted with the State Natural Resources Commission for topographic engineering on Willow Creek and the contour maps were delivered. The NRD also administrates the Nebraska Water Conservation Fund, which may be applied for when federal cost share limits have been reached.

Most best management practices offered in the RCWP are compatable with the Natural Resources District long range master plan.

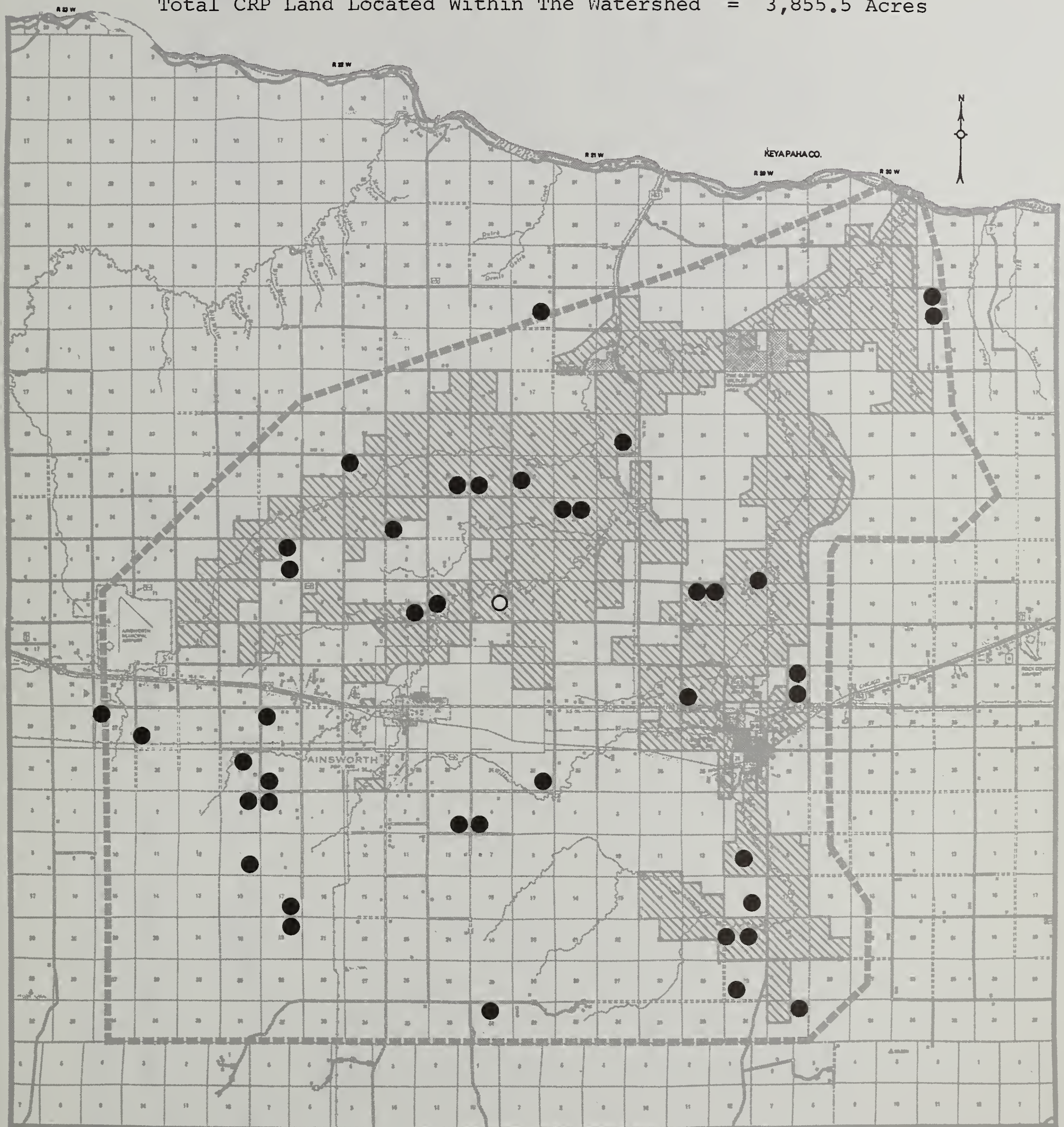
RC&D

The North Central Nebraska Resource Conservation and Development (RC&D)Program, funded and administered by the Soil Conservation Service, is currently involved in the process of assisting the Long Pine RCWP with projects that the RCWP cannot address or for which it lacks the necessary funds. The RC&D program is set up to work with groups of individuals, local municipalities and units of government. The RCWP, in contrast, is designed to work mainly with individuals in dealing with non-point source pollution problems. Thus, the RC&D program fills gaps where there are serious point source water quality problems which the RCWP cannot address, this is why the two programs complement themselves so well. Currently, the RC&D program is proceeding with a design for erosion control devices on old Highway 20 south of the Long Pine Recreation Area. This is in conjunction with the city of Long Pine, Brown County Commissioners and the Middle Niobrara NRD. Another area of concern is the feedlots on Bone Creek. The RC&D program is working on designs for feedlot operators that will be suited to each individual's needs along with delivery systems for putting the wastes on adjoining cropland. In the future, the RC&D program may assist with some of the larger water control structures if they become feasible.

It is hoped that through the combined efforts of both programs, other agencies and units of government the water quality in the watershed will be greatly enhanced along with the abatement of soil erosion.

LAND ENROLLED IN THE
CONSERVATION RESERVE PROGRAM (CRP)
DAIRY TERMINATION PROGRAM (DTP)

CRP Land Located Within The Critical Area	=	1,206.8 Acres
CRP Land Adjacent To The Critical Area	=	1,011.2 Acres
Other CRP Land Within The Project Area	=	1,637.5 Acres
Total CRP Land Located Within The Watershed	=	3,855.5 Acres



Project Area

Critical Area

Land Enrolled in the CRP

Farms Enrolled in the DTP

DATA LOG FORMAT: (Page 1 of 2)

TECHNICAL AND COST-SHARE DATA RECORDED BY BMP ITEM

DATE	RCWP CONTRACT	SUBBASIN NUMBER	BMP NO.	PRACTICE CODE-DESCRIPTION	PRACTICE COST-SHARE	OR	PRACTICE NONCOST-SHARE

1.
2. **NOTE:**
3. According to the RCWP manual, Individual ACP-245s are issued at the
4. beginning of each Fiscal Year for each planned cost-shared BMP. These
5. serve as a reminder of scheduled BMPs, provide claim for cost-share payment
6. and account for disbursement of cost-share. Upon Certification by SCS that
7. BMPs have been properly installed, the producer can receive cost-share
8. payment. SCS certifies that the practice has been completed by returning
9. a copy of the Conservation Reporting and Evaluation System Data Sheet
10. (AD-862 CRES Form) with the ACP-245 to ASCS. The cost-share payment can
11. then be made to the producer.
12.
13. At this point all of the information pertaining to BMP costs and technical
14. data are in one place. The CRES form has all of the technical data pertaining
15. to each BMP. The installation costs and cost-share information is present.
16. This is when the data log should be addressed. Whenever a cost-share payment
17. is made the RCWP program assistant can use the data log to document cost-share
18. practices. When annual status reviews are performed, SCS technicians can use
19. the data log to record noncost-share practices. This data log would be easily
20. accessible at any point during the project. At the end of the project, all of
21. the information regarding all of the BMPs is in one place. The data can be
22. entered into a computer at any point and sorted accordingly.
23.
24.
25.

DATA LOG FORMAT: (Page 2 of 2)

TECHNICAL AND COST-SHARE DATA RECORDED BY BMP ITEM

INSTALLATION COSTS	COST-SHARE	ACRES SERVED	UNITS APPLIED	*MISC. UNIT REPORTED	SOIL LOSS SAVINGS (T/ACRE)	WATER SAVED (AC.FT.)

1.
2. **NOTE:** All columns are not applicable to every practice.
3. The purpose of the data log is to record ALL of the relevant data
4. for each practice installed or implemented. Because it is difficult
5. to know what data will be considered pertinent a decade from now, it will
6. be necessary to record all of the information regarding each practice that
7. is available. If data other than what is noted in the format is available,
8. applicable columns should be added to this two-page format, and the data
9. recorded.
10.
11.
12.
13.
14.
15.
16.
17.
18. ***Misc. Unit Reported** are units of interest that are reported such as the
19. number of trees for tree planting, cubic yards in regard to structures, etc.
20. Misc. Unit Reported is not the 'Units Applied' data that is officially
21. reported by the Soil Conservation Service technicians on CRES forms.
22.
23.
24.
25.

CONSTRUCTION NOTES

FOR CEDAR REVETMENT

SPACE STEEL "T" POSTS AT APPROXIMATELY 10 FT. INTERVALS. PLACE ANCHOR DEAD-MAN AT A NON TURBULENT SPOT, SO AS NOT TO "CUT" BEHIND ANCHOR. IF NOT POSSIBLE, LOCATE ANCHOR APPROXIMATELY 10 FT. INTO BANK, AWAY FROM CHANNEL, AT 45 DEGREE TO 90 DEGREE ANGLE WITH RESPECT TO SHORELINE. DRIVE POSTS INTO GROUND, EXPOSING 1/2 TO 1 FT. OF "T" POST, NORMALLY IN A STABLE BANK. IN VERTICAL OR VERY STEEP BANKS DRIVE POST INTO STREAMBANK AT 30 DEGREE TO 45 DEGREES.

STRETCH 3/8 OR 5/16 INCH STEEL (AIRCRAFT TYPE) CABLE FROM ANCHOR DEAD-MAN (USUALLY CONSISTING OF 2 "T" POSTS CROSSED) TO LAST POST ON REVETMENT, USING A LOOP OR MULTIPLE LOOPS AND CLAMPS TO SECURE CABLE TO ANCHOR AND LAST POST.

HOLES SHOULD BE DRILLED THROUGH POSTS AND PASS CABLE THROUGH HOLES IN POSTS THROUGHOUT REVETMENT LINE OR TIE CABLE TO ALL MIDDLE "T" POSTS WITH NO. 9 SOFT WIRE.

BEGIN REVETMENT AT DOWNSTREAM END AND WORK UPSTREAM. TIE TRUNK OF TREE 2 OR 3 TIMES WITH WIRE.

TIE APPROXIMATELY 2 TO 4 TREES WITH TRUNK DIA. OF 4 TO 6 INCHES IN A 10 FT. SPACE OF WHICH 4 FT., MORE OR LESS, REMAINS ON BANK. TREES MAY BE TRIMMED BACK FROM BASE 3 TO 4 FT., LEAVING STUB BRANCHES 6 TO 8 INCHES TO FACILITATE TIEING TO CABLE AND FITTING TO STREAMBANK. THE BUSHIER TREE IS BETTER WITH SEVERE (RAW STEEP) BANKS, A ROW OF CEDARS SHOULD BE PLACED LONGITUDINAL ALONG PATH OF CABLE AFTER MAIN REVETMENT HAS BEEN PLACED DIAGONALLY.

UNDER NO CIRCUMSTANCES SHOULD REVETMENT INCLUDE MORE THAN 1/3 OF STREAM WIDTH ACCORDING TO RULES OF U.S. CORPS OF ENGINEERS.

PLANT VEGETATION (USUALLY REED CANARY GRASS OR SPRIGS) AS SOON AS SEDIMENT DEPOSITS ALLOW.

CONSTRUCTION NOTES

FOR CEDAR WING-DIKE REVETMENT

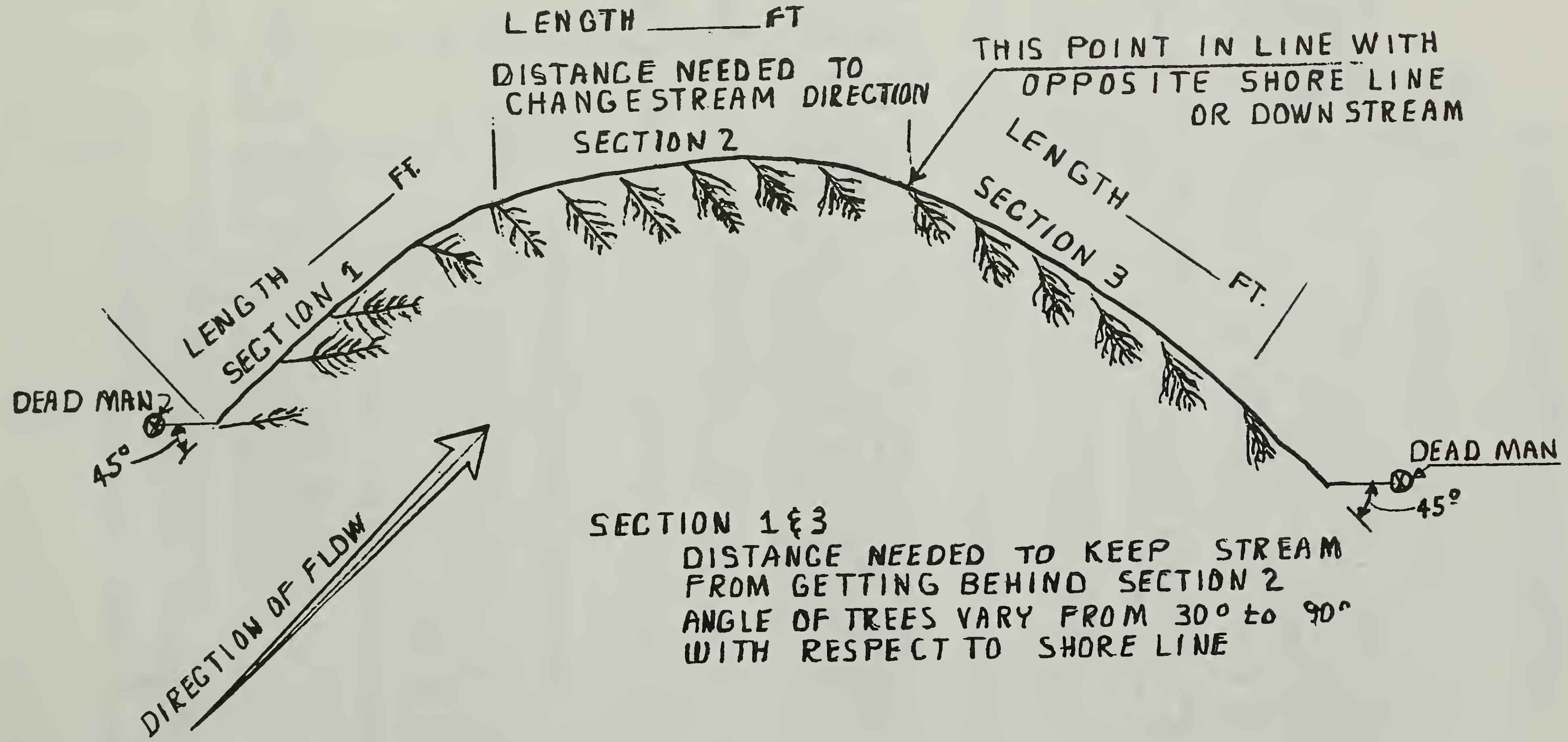
WING DIKES SHALL CONSIST OF 2 CEDAR TREES PLACED 1ST DIAGONALLY WITH STREAM CURRENT, AND 2ND LONGITUDINAL ALONG STREAM BANK.
TREES WILL BE ANCHORED WITH 1 "T" POST AND TIED WITH NO. 9 GA. SOFT WIRE A MINIMUM OF THREE SEPARATE TIES.

WING DIKES WILL BE APPROXIMATELY 20 FT. APART.

TREES WITH TRUNK DIA. OF 4 TO 6 INCHES AND LENGTHS AVERAGING 15 FT. SHOULD BE USED. DRIVE POST BETWEEN BRANCHES AND SECURE TREES TO POST WITH WIRE, OR THE TREES MAY BE TRIMMED BACK FROM BASE 3 TO 4 FT. LEAVING STUB BRANCHES 2 TO 4 INCHES TO FACILITATE TIEING TO ANCHOR AND FITTING TO STREAM BANK.

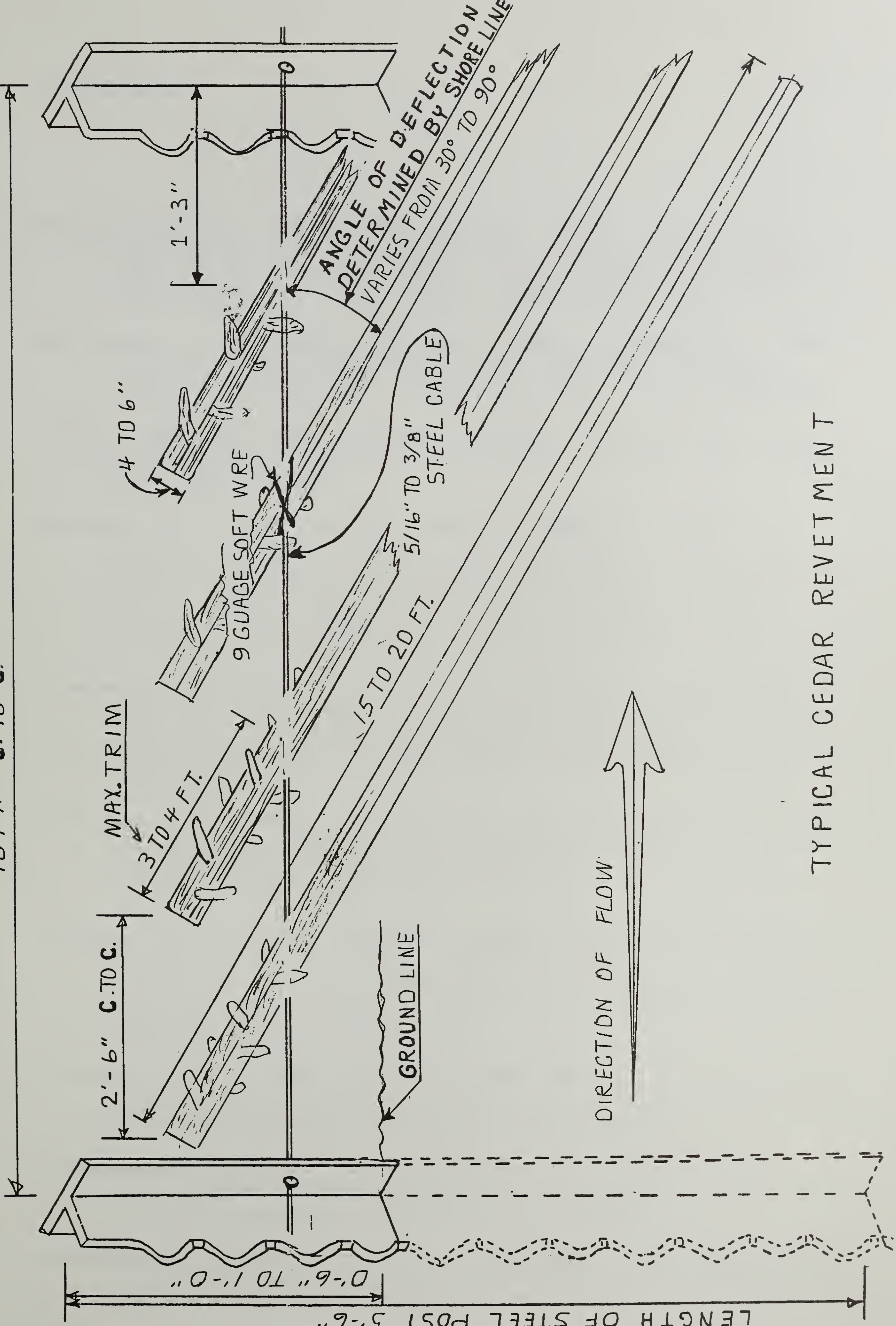
UNDER NO CIRCUMSTANCES SHALL REVETMENT DIKE INCLUDE MORE THAN 1/3 OF STREAM WIDTH ACCORDING TO U.S. CORPS OF ENGINEERS.

PLANT VEGETATION (USUALLY REEDS CANARY GRASS OR SPRIGS) AS SOON AS SEDIMENT DEPOSITS ALLOW.



PLAN VIEW

CEDAR REVETMENT



TYPICAL CEDAR REVETMENT

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ACRES BY SUBBASIN
LONG PINE CREEK RCWP

SUBBASIN NUMBER	TOTAL ACRES WITHIN SUBBASIN	CRITICAL ACRES	CRITICAL ACRES UNDER CONTRACT	CRITICAL ACRES NOT UNDER CONTRACT
1	19,948	1,218	1,093	125
2	19,295	8,601	5,430	3,171
3	60,112	305	250	55
4	11,006	5,155	3,805	1,350
5	10,908	6,620	3,851	2,769
6	15,393	7,736	4,936	2,800
7	9,080	3,399	2,559	840
8	22,177	2,406	1,806	600
9	24,566	5,114	2,414	2,700
10	98,468	5,711	3,211	2,500
11	11,439	6,949	6,629	320
12	22,596	7,028	6,848	180
TOTALS:	324,988	60,242	42,832	17,410

71% of the Critical Area Under Contract

GENERAL SOIL ASSOCIATIONS DESCRIPTION

The Long Pine Creek Watershed is underlain by rocks from the Cretaceous and Tertiary age. The oldest exposed formation is the Pierre shale of the Cretaceous age. It is overlain successively by the Ogallala formation of Pliocene age and surficial deposits of Quaternary age.

A blanket of loess and aeolian sand material covers most of the watershed. The loess and sands are generally underlain by gravelly outwash material that is exposed along some of the steeper slopes adjacent to the drainageways. The area of incised tableland contains large areas of flat to gently rolling crop and rangeland dissected by moderate to steeply sloping stream channels and gullies. Geologic formations are erodible being unconsolidated to poorly consolidated sands with gravel, silt and some clay.

There are nine main classifications of soil associations found throughout the project area. They are identified by the SCS as:

Nearly Level to Hilly Soils in the Sandhills:

1. Valentine Association - deep, nearly level to hilly, excessively drained sandy soil formed in eolian sand.

2. Simeon-Valentine Association - deep, nearly level to steep, excessively drained sandy soils formed in eolian, alluvial, and outwash sands on breaks to the Niobrara River Valley.

The Valentine Association is found mainly along the southern portion of the project area.

The Simeon-Valentine Association is found only along the headwater areas of the Sand Draw, Willow and Long Pine Creeks.

Nearly Level and Strongly Sloping Soils on Bottom Lands, Sandhills and Sandhills Valleys:

3. Valentine-ELS-Ipage Association - Deep, nearly level to strongly sloping, excessively drained through very poorly drained sandy soils formed in eolian and alluvial sands on bottom lands and in sandhill valleys.

4. Loup-ELS-Tryon Association - Deep, nearly level and very gently sloping somewhat poorly drained to very poorly drained loamy and sandy soils formed in alluvial and

eolian sands on bottom lands.

Highway 2Ø runs east-west through the center of the project area. Associations 3 and 4 are located in areas south of Highway 2Ø.

Nearly Level to Rolling Soils on Tablelands, Uplands and in the Sandhills:

5. Johnstown-Jansen Association - Moderately deep to deep, nearly level to gently sloping, well drained soils on uplands.

6. Valentine-Ronson-Tassel Association - Shallow through deep, nearly level through rolling, well drained through excessively drained loamy and sandy soils on uplands.

7. Valentine-O'Neill-Pivot Association - nearly level to strongly sloping, well drained to excessively drained sandy and loamy soils that are moderately deep or deep over sand and gravel on uplands.,

8. Jansen-O'Neill-Meadin Association - Nearly level to gently sloping, well drained to excessively drained sandy and loamy soils that are moderately deep or deep over coarse and gravelly coarse sand on uplands.

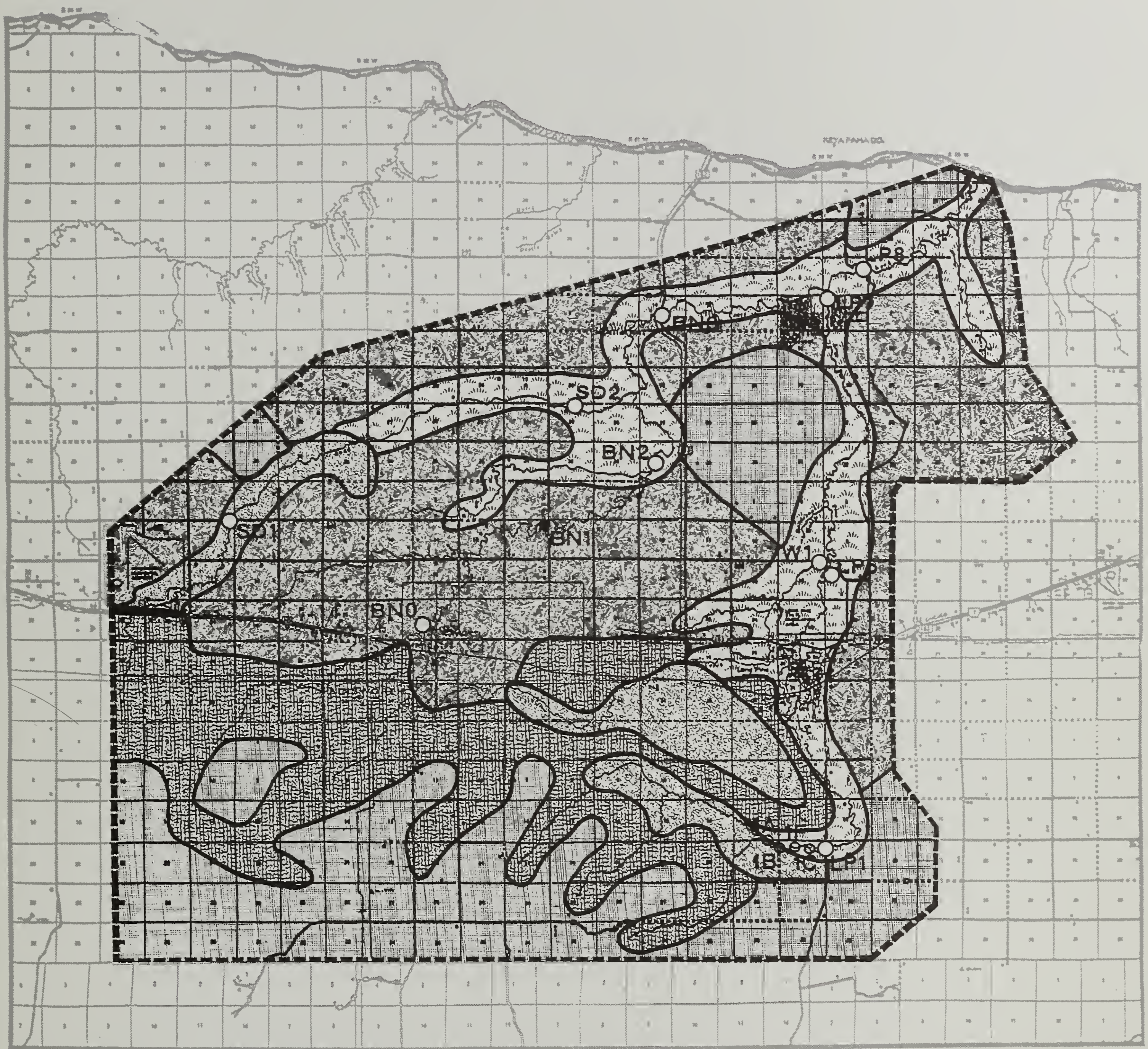
Associations 5, 6, 7, and 8, are located along the southern edge of Highway 2Ø and throughout the northern portion of the project area, excluding areas immediately adjacent to the creeks.

Strongly Sloping to Very Steep Sandy Soils on Breaks to the Niobrara River Valley:

9. McKelvie-Tassel-Ronson Association - Shallow through deep, strongly sloping to very steep, well drained through excessively drained sandy and loamy soils that formed in eolian sands or residuum weathered from sandstone.

The McKelvie-Tassel-Ronson Association is located along areas adjacent to all creeks and streams, with the exception of the area at the headwaters.

GENERAL SOIL ASSOCIATIONS MAP



Soil Associations:

1

2

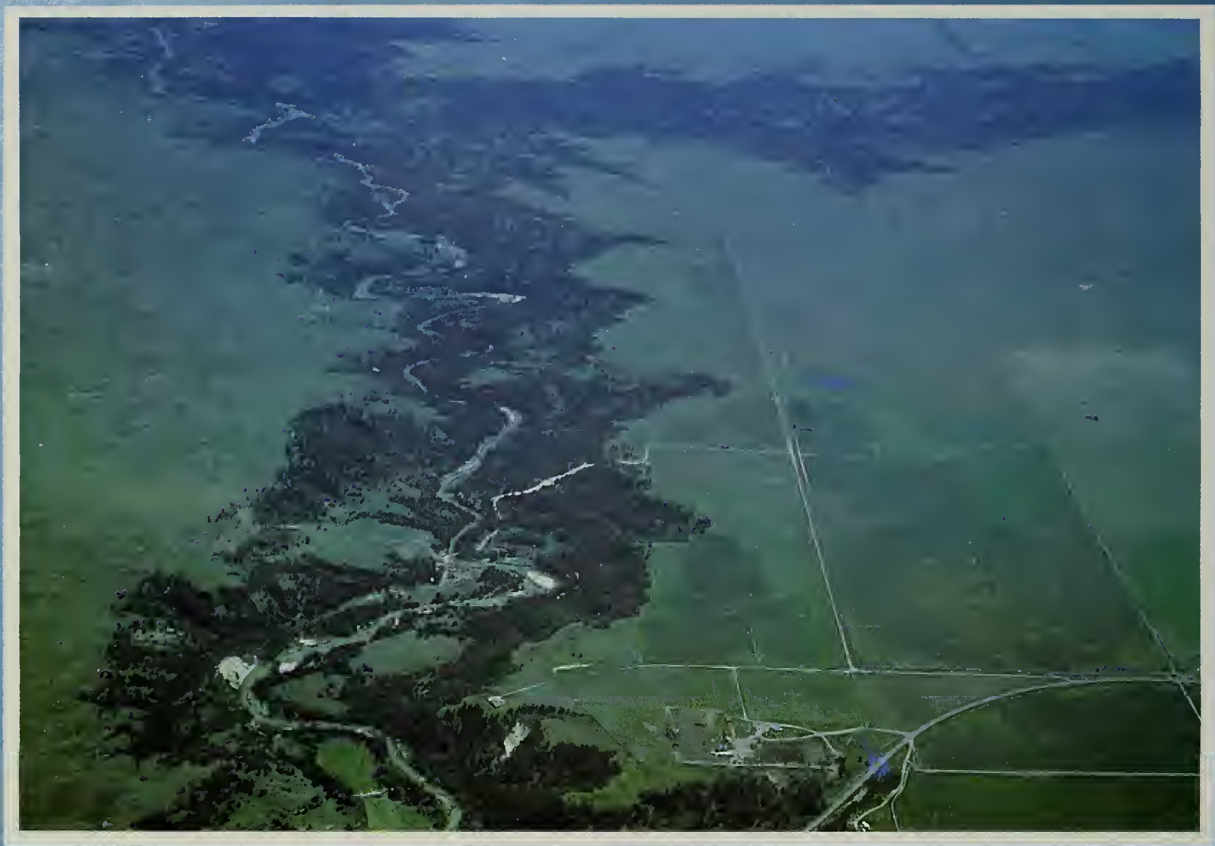
9

#3, #4

#5, #6, #7, #8

Project Area

Monitoring Stations



Long Pine Creek Winding North

Railroad Bridge Near Long Pine